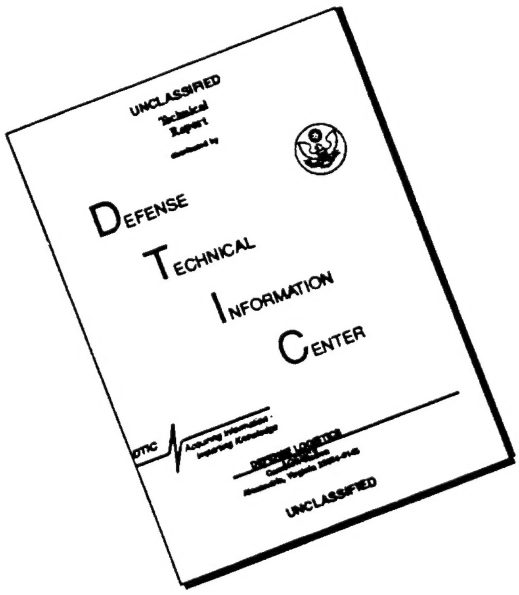
U C L A

ENVIRONMENTAL

SCIENCE &

ENGINEERING

DISCLAIMER NOTICE



THIS DOCUMENT IS BEST QUALITY AVAILABLE. THE COPY FURNISHED TO DTIC CONTAINED A SIGNIFICANT NUMBER OF PAGES WHICH DO NOT REPRODUCE LEGIBLY.

UNIVERSITY OF CALIFORNIA, LOS ANGELES

UCLA

BERKELEY · DAVIS · IRVINE · LOS ANGELES · RIVERSIDE · SAN DIEGO · SAN FRANCISCO

SANTA BARBARA · SANTA CRUZ

ENVIRONMENTAL SCIENCE AND ENGINEERING
SCHOOL OF PUBLIC HEALTH
10833 LE CONTE AVENUE
LOS ANGELES, CALIFORNIA 90024-1772

April 26, 1990

Mark Besmer
Program Manager's Office for
Rocky Mountain Arsenal Contamination Cleanup
Building 111
Commerce City, Colorado 80022-2188

Dear Mark:

You asked for some clarification regarding the "conservative, nontoxic tracer" we would propose to use in field studies near the Basin F area at the Arsenal. In all good field work on contaminant transport in groundwater, one or more chemicals, usually simple salts (discussed below), are added to serve as conservative tracers. This has been the case in a variety of field experiments conducted by universities, U.S. Geological Survey and Canadian governmental research agencies, as detailed below. The term "conservative" implies that the chemical does not adsorb to the geologic medium (sand, silt, clay, etc.) nor does it degrade or transform during its passage through the medium. With these properties, the tracer mimics the movement of the water itself. By comparing the tracer behavior to that of the contaminants, it is possible to unambiguously determine if the contaminants are adsorbed or degraded as they move through the medium. If no tracer is used, the interpretation of the behavior of the contaminants is difficult if not impossible, especially when quantitative estimates of transport parameters are desired such as in our work.

The chemicals that have generally been used as conservative tracers in previous field work (and confirmed to act conservatively, i.e. not adsorb or degrade) are simple salts containing chloride, bromide or iodide, such as sodium chloride (table salt), potassium chloride, sodium bromide, potassium bromide, potassium iodide, etc. Whether the salt contains sodium or potassium is generally a matter of whichever salt is cheaper, more available, etc. Examples of tracers used in previous field work are the following:

Sodium Chloride and Potassium Bromide

Canadian Forces Base Borden, Ontario, Canada.
This was a field experiment on organic contaminant transport in a sand aquifer impacted by a plume of contamination from a landfill. The work was conducted by Stanford University in collaboration with the University of Waterloo; I was the designer and implementer of the experiment. Approval for the work was obtained from the Canadian Forces by Professor John Cherry of the University of Waterloo. Two tracers were used for redundancy; both behaved conservatively for over three years of observation. Results are published in December 1986 issue of the scientific journal Water Resources Research. This work was sponsored by the U.S. E.P.A.

Sodium Iodide

Gloucester, Ontario, Canada.
This was a field experiment to determine the rate at which contaminants from a hazardous waste landfill could be flushed from a sand aquifer. The work was conducted by the Canadian National Hydrology Research Institute in Ottawa, Canada. The concern was that the organic contaminants were migrating towards a water supply and information on their rate of migration was needed to plan the cleanup. Thus the tracer was crucial to their experiment.

Sodium Bromide

Mobile, Alabama.

This was a large field experiment on tracer behavior in a layered sand aquifer. No organic contaminants were present. The main purpose was to use the tracer to determine the relative permeability of the various layers in the aquifer. This work was sponsored by the U.S.E.P.A. It has been described in numerous publications in scientific journals such as Water Resources Research, Ground Water, etc.

Lithium Bromide

Otis Air Force Base, Cape Cod, Massachusetts.

This was a large scale field experiment on solute transport in a sand aquifer impacted by sewage infiltration beds. The work was conducted by the United States Geological Survey in collaboration with the Massachusetts Institute of Technology. The lithium salt was used because of interest in the behavior of lithium itself, which was not conservative (i.e. interacted with the geologic mediaum). The bromide tracer was shown to have been conservative over a span of several years in a paper now in press in the scientific journal Water Resources Research. Aspects of the work are also described in a recent article in the journal Science (vol. 247, pp.1569-1572, March 1990).

Potassium Bromide

Moffett Naval Air Station, Mountain View, California.

This is an ongoing evaluation of in-situ bioremediation being conducted in a sand/gravel aquifer by Stanford University. I was managing the project at its start before I moved to UCLA, and secured approval from the California Regional Water Quality Control Board and the Environmental Protection Agency prior to beginning the field research. Since that time, there have been many short term experiments involving the injection of the tracer. It has been shown to be conservative in its behavior in a report available through the National Technical Information Service (NTIS #PB88-130257, Nov 87) and a paper now in press in the scientific journal Ground Water. This work is funded by the U.S.E.P.A.

Potassium Iodide

Rocky Mountain Arsenal, Commerce City, Colorado.

This was the experiment I conducted with my group from UCLA and in collaboration with Ebasco, Inc. and R.L. Stollar and Associates. The experiment, conducted in Summer 1988, determined the rate of flushing of two organic contaminants from the sand aquifer. Iodide was used as the tracer since 1) background chloride levels were too high for use to use chloride as a tracer, 2) the various parties reviewing our plans readily accepted iodide as a harmless, nontoxic chemical (since it is used in table salt as a nutritional supplement), and 3) we guessed that the parties were less familiar with potassium bromide and chose not to attempt an argument for it.

Not all field studies are listed above, but this brief review illustrates that the most frequently used tracers are bromide salts. They have been used for studies in contaminated aquifers in the U.S. and Canada by a variety of researchers, all working with government funding. Of course, one would prefer not to add salt to an aquifer, but it is generally acknowledged that the very slight degradation caused by the use of the tracer is absolutely insignificant by comparison to the improvement in

understanding of the behavior of the much more worrisome contaminants, and the corresponding improvement in understanding of how to manage or clean up the contamination problem.

In any future work we might receive approval to conduct at the Rocky Mountain Arsenal, we would prefer to use sodium or potassium bromide, with sodium or potassium iodide as a second choice. Like all chemicals, including table salt, these salts possess some toxicity to animals if the dose is extremely high (several hundred to thousand milligrams per kilogram body weight). No such exposures would be remotely possible in our work. We plan to inject into the aquifer a 24-48 hour pulses of the tracer in concentrations on the order of 300 milligrams per liter, which is actually quite low (roughly equivalent to a quarter teaspoon of salt in a glass of water). No person is likely to be exposed even to those concentrations, of course, since the groundwater on the Arsenal near Basin F is contaminated with organic compounds and is not used for drinking. However, even if they were, it is unlikely the bromide or iodide salts would have a detrimental or even noticeable impact: for example, potassium bromide has medicinal use in lower doses as a sedative (hence the now outdated expression "take a bromide"), while potassium iodide is routinely added to table salt as a nutritional supplement.

I hope this addresses the issue we discussed. If I can provide any additional information, please let me know. Thanks for your continued interest in this work. I think the proposed project will prove very useful for your managment or cleanup efforts while also very intriguing from a scientific point of view.

Sincerely,

Douglas M. Mackay

Douglas M. Mackay
Assistant Professor

cc: R. Stollar, R.L. Stollar and Associates
K. Glover, R.L. Stollar and Associates

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. AGENCY USE ONLY *(Leave blank)*	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	04/00/90	

4. TITLE AND SUBTITLE
FLUSHING OF ORGANIC CONTAMINANTS FROM A GROUNDWATER PLUME AT THE ROCKY MOUNTAIN ARSENAL

5. FUNDING NUMBERS

6. AUTHOR(S)
MACKAY, D.; THORBJARNARSON, K.

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
UNIVERSITY OF CALIFORNA, LOS ANGELES. SCHOOL OF PUBLIC HEALTH
LOS ANGELES, CA

8. PERFORMING ORGANIZATION REPORT NUMBER
90218R01

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)

10. SPONSORING/MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION/AVAILABILITY STATEMENT
APPROVED FOR PUBLIC RELEASE; DISTRIBUTION IS UNLIMITED

12b. DISTRIBUTION CODE

13. ABSTRACT *(Maximum 200 words)*

DURING THE SUMMER OF 1988, UCLA CONDUCTED A FIELD EXPERIMENT ON FLUSHING OF ORGANIC CONTAMINANTS FROM A CONTAMINATED AQUIFER IN THE WESTERN TIER OF RMA. THE OBJECTIVES OF THE STUDY WERE TO:

1. ESTIMATE THE HYDRAULIC CONDUCTIVITY OF THE AQUIFER
2. ESTIMATE THE DEGREE TO WHICH TRCLE AND 111TCE ARE RETARDED IN THEIR MOBILITY DUE TO SORPTION BY THE AQUIFER MEDIA
3. DETERMINE THE EFFECTS OF SPATIAL VARIABILITY OF AQUIFER PROPERTIES ON WATER FLOW AND TRCLE AND 111TCE FLUSHING RATES
4. COMPARE RESULTS OF FIELD AND LABORATORY INVESTIGATIONS.

THE LABORATORY ANALYSES OF CORING SAMPLES INDICATED THAT BOTH THE HYDRAULIC CONDUCTIVITY OF THE AQUIFER AND THE TRCLE MOBILITY ARE LIKELY TO VARY SIGNIFICANTLY WITH DEPTH. THE FIELD EXPERIMENT CONSISTED OF 1) AIR STRIPPING EXTRACTED WATER, 2) SPIKING IT WITH A TRACER, AND 3) REINJECTING IT. THE FIELD DATA SHOW THAT FLUSHING WILL BE VERY EFFICIENT IN THE HIGHLY PERMEABLE STRATA,

14. SUBJECT TERMS	15. NUMBER OF PAGES
LABORATORY STUDIES, WELL CONSTRUCTION, HYDRAULIC CONDUCTIVITY ESTIMATES	16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
UNCLASSIFIED			

FLUSHING OF ORGANIC CONTAMINANTS FROM A GROUND WATER PLUME AT THE ROCKY MOUNTAIN ARSENAL: VOLUME II. APPENDICES

Douglas M. Mackay, Ph.D
Kathryn W. Thorbjarnarson
UCLA School of Public Health
Environmental Science and Engineering
Los Angeles, CA 90024-1772

ES&E Tech. Report No. 90-69
April 1990

TABLE OF CONTENTS

INTRODUCTION

In this volume, appendices containing various raw and reduced data are presented. These appendices are referred to in the text of the first volume "Flushing of Organic Contaminants from a Ground Water Plume at the Rocky Mountain Arsenal: Volume I. Field and Laboratory Studies.

APPENDIX A. GRAIN SIZE PARAMETERS

GRAIN SIZE PARAMETERS

Core #	Depth interval (ft)[1]	Mean (phi)	Sorting (phi)	Description
1	59.50-61.00	0.11	1.43	poorly sorted coarse sand
1	61.00-62.00	-0.65	1.45	poorly sorted very coarse sand
1	62.00-63.50	-0.62	1.64	poorly sorted very coarse sand
1	69.25-70.25	-0.04	1.53	poorly sorted very coarse sand
1	70.25-71.25	-0.31	1.30	moderately sorted very coarse sand
1	71.25-72.00	0.09	1.44	poorly sorted coarse sand
1	74.00-75.00	0.29	1.54	poorly sorted coarse sand
1	75.00-76.00	0.22	1.34	moderately sorted coarse sand
1	76.00-77.00	0.49	1.22	moderately sorted coarse sand
1	77.00-78.00	0.72	1.15	moderately sorted coarse sand
1	78.00-79.00	0.70	1.10	moderately sorted coarse sand
1	79.00-80.00	1.33	1.07	moderately sorted medium sand
1	80.00-81.00	0.38	1.45	poorly sorted coarse sand
1	81.00-81.75	-0.42	1.53	poorly sorted very coarse sand
1	81.75-82.75	0.80	1.28	moderately sorted coarse sand
1	82.75-83.75	-0.17	1.59	poorly sorted very coarse sand
1	84.00-85.25	0.91	1.19	moderately sorted coarse sand
1	85.25-86.25	0.26	1.57	poorly sorted coarse sand
1	86.25-87.25	0.94	1.97	poorly sorted coarse sand
1	87.25-88.50	0.42	2.01	very poorly sorted coarse sand
2	56.50-57.50	0.49	1.56	poorly sorted coarse sand
2	57.50-58.50	-0.06	1.54	poorly sorted very coarse sand
2	58.50-59.50	-0.46	1.62	poorly sorted very coarse sand
2	59.50-60.50	-1.03	1.78	poorly sorted gravel
2	60.50-61.50	-0.60	1.72	poorly sorted very coarse sand
2	64.00-65.00	0.25	1.40	poorly sorted coarse sand
2	65.00-66.00	-1.06	1.72	poorly sorted gravel
2	66.00-67.00	-1.69	1.61	poorly sorted gravel
2	67.00-68.00	-1.06	1.43	poorly sorted gravel
3	59.80-61.05	-0.08	1.53	poorly sorted very coarse sand
3	61.05-62.30	-0.07	1.84	poorly sorted very coarse sand
3	64.80-65.80	-0.96	1.67	poorly sorted very coarse sand
3	65.80-66.80	-0.92	1.55	poorly sorted very coarse sand
3	66.80-67.80	-0.87	1.59	poorly sorted very coarse sand
3	67.80-69.80	-1.00	1.73	poorly sorted very coarse sand
3	69.80-70.80	0.15	1.21	moderately sorted coarse sand
3	70.80-71.80	-1.24	1.63	poorly sorted gravel
3	71.80-72.80	-1.59	1.91	poorly sorted gravel
3	72.80-74.30	-0.42	2.68	extremely poorly sorted v.c. sand
3	74.80-75.80	1.36	1.10	moderately sorted medium sand
3	75.80-76.80	0.69	1.39	moderately sorted coarse sand
3	76.80-77.80	0.97	1.03	moderately sorted coarse sand
3	77.80-78.80	0.91	1.24	moderately sorted coarse sand
3	79.80-80.80	0.78	1.03	moderately sorted coarse sand
3	80.80-81.80	0.87	1.16	moderately sorted coarse sand
3	81.80-82.80	-0.72	2.54	very poorly sorted very coarse sand
3	82.80-83.80	0.25	1.49	poorly sorted coarse sand
3	86.05-86.30	1.18	1.45	poorly sorted medium sand

(1) All depths relative to a ground elevation of 5176.4 ft

Method of Moments Grain Size Analysis
RMA 33080
Sample 59.5-61

Phi Class Midpoint	Wt (g)	Wt %	Midpt*Wt%	Deviation Mpt-Mean
-2.5	93.2	8.02	-20.06	-2.61
-1.5	153.2	13.19	-19.78	-1.61
-0.5	283.6	24.42	-12.21	-0.61
0.5	361.1	31.09	15.54	0.39
1.5	177.5	15.28	22.92	1.39
2.5	55	4.74	11.84	2.39
3.5	23.7	2.04	7.14	3.39
4.5	14.2	1.22	5.50	4.39
	1161.5	100	10.90	

Phi Class Midpoint	Dev*2	Wt%*Dev*2	Wt%*Dev*3	Wt%*Dev*4
-2.5	6.81	54.62	-142.49	371.76
-1.5	2.59	34.14	-54.94	88.39
-0.5	0.37	9.05	-5.51	3.36
0.5	0.15	4.75	1.86	0.73
1.5	1.94	29.57	41.13	57.22
2.5	5.72	27.07	64.73	154.77
3.5	11.50	23.46	79.57	269.81
4.5	19.28	23.57	103.51	454.51
		206.25	87.85	1400.55

First Moment:
Mean = Sum(Wt%*Midpt)/100
= 0.1089539

Second Moment:
Dispersion= Sum((Wt%)*(Dev*2))/100
= 2.0624940

Square Root of Second Moment:
Standard Deviation= 1.4361386

Third Moment = Sum((Wt%)*(Dev*3))/100
= 0.8785272
Skewness = Third Moment/(Standard deviation*3)
= 0.2965965

Fourth Moment = Sum((Wt%)*(Dev*4))/100
= 14.005503
Kurtosis = Fourth Moment/(Standard Deviation*4)
=3.2924053

Method of Moments Grain Size Analysis

RMA 33080

Sample	61-62			
Phi Class Midpoint	Wt (g)	Wt %	Midpt*Wt%	Deviation Mpt-Mean
-2.5	152	20.72	-51.80	-1.85
-1.5	159.8	21.78	-32.67	-0.85
-0.5	204.1	27.82	-13.91	0.15
0.5	137.8	18.78	9.39	1.15
1.5	45.8	6.24	9.36	2.15
2.5	19	2.59	6.47	3.15
3.5	8.6	1.17	4.10	4.15
4.5	6.5	0.89	3.99	5.15
	733.6	100	-65.06	

Phi Class Midpoint	Dev*2	Wt%*Dev*2	Wt%*Dev*3	Wt%*Dev*4
-2.5	3.42	70.87	-131.06	242.37
-1.5	0.72	15.71	-13.35	11.34
-0.5	0.02	0.63	0.10	0.01
0.5	1.32	24.87	28.61	32.93
1.5	4.63	28.88	62.10	133.56
2.5	9.93	25.71	81.00	255.20
3.5	17.23	20.20	83.83	347.93
4.5	26.53	23.51	121.07	623.58
		210.37	232.30	1646.92

First Moment:
Mean = Sum(Wt%*Midpt)/100
= -0.650627

Second Moment:
Dispersion= Sum((Wt%)*(Dev*2))/100
= 2.1036746

Square Root of Second Moment:
Standard Deviation= 1.4504049

Third Moment = Sum((Wt%)*(Dev*3))/100
= 2.3230305

Skewness = Third Moment/(Standard deviation*3)
= 0.7613547

Fourth Moment = Sum((Wt%)*(Dev*4))/100
= 16.469216

Kurtosis = Fourth Moment/(Standard Deviation*4)
=3.7214808

Method of Moments Grain Size Analysis
RMA 33080
Sample 62-63.5

Phi Class Midpoint	Wt (g)	Wt %	Midpt*Wt%	Deviation Mpt-Mean
-2.5	289.3	27.49	-68.74	-1.88
-1.5	188.3	17.90	-26.84	-0.88
-0.5	202	19.20	-9.60	0.12
0.5	212.2	20.17	10.08	1.12
1.5	92.3	8.77	13.16	2.12
2.5	38.4	3.65	9.12	3.12
3.5	17.8	1.69	5.92	4.12
4.5	11.9	1.13	5.09	5.12
	1052.2	100	-61.80	

Phi Class Midpoint	Dev*2	Wt%*Dev*2	Wt%*Dev*3	Wt%*Dev*4
-2.5	3.54	97.38	-183.27	344.90
-1.5	0.78	13.92	-12.28	10.83
-0.5	0.01	0.27	0.03	0.00
0.5	1.25	25.21	28.18	31.51
1.5	4.49	39.35	83.35	176.54
2.5	9.72	35.48	110.63	344.95
3.5	16.96	28.69	118.14	486.50
4.5	26.19	29.62	151.62	776.00
		269.92	296.41	2171.24

First Moment:
Mean = Sum(Wt%*Midpt)/100
= -0.618038

Second Moment:
Dispersion= Sum((Wt%)*(Dev*2))/100
= 2.6992393

Square Root of Second Moment:
Standard Deviation= 1.6429361

Third Moment = Sum((Wt%)*(Dev*3))/100
= 2.9641390
Skewness = Third Moment/(Standard deviation*3)
= 0.6684000

Fourth Moment = Sum((Wt%)*(Dev*4))/100
= 21.712363
Kurtosis = Fourth Moment/(Standard Deviation*4)
=2.9800552

Method of Moments Grain Size Analysis

RMA 33080

Sample 69.25-70.25

Phi Class Midpoint	Wt (g)	Wt %	Midpt*Wt%	Deviation Mpt-Mean
-2.5	125.9	15.96	-39.90	-2.46
-1.5	72.5	9.19	-13.79	-1.46
-0.5	167	21.17	-10.59	-0.46
0.5	251.1	31.83	15.92	0.54
1.5	111.7	14.16	21.24	1.54
2.5	39.2	4.97	12.42	2.54
3.5	15.6	1.98	6.92	3.54
4.5	5.8	0.74	3.31	4.54
	788.8	100	-4.46	

Phi Class Midpoint	Dev*2	Wt%*Dev*2	Wt%*Dev*3	Wt%*Dev*4
-2.5	6.03	96.23	-236.27	580.14
-1.5	2.12	19.47	-28.33	41.24
-0.5	0.21	4.39	-2.00	0.91
0.5	0.30	9.44	5.14	2.80
1.5	2.39	33.79	52.19	80.61
2.5	6.48	32.18	81.88	208.36
3.5	12.56	24.85	88.08	312.20
4.5	20.65	15.19	69.02	313.66
		235.53	29.70	1539.91

First Moment:
Mean = Sum(Wt%*Midpt)/100
= -0.044624

Second Moment:
Dispersion= Sum((Wt%)*(Dev*2))/100
= 2.3552601

Square Root of Second Moment:
Standard Deviation= 1.5346856

Third Moment = Sum((Wt%)*(Dev*3))/100
= 0.2970151
Skewness = Third Moment/(Standard deviation*3)
= 0.0821713

Fourth Moment = Sum((Wt%)*(Dev*4))/100
= 15.399111
Kurtosis = Fourth Moment/(Standard Deviation*4)
=2.7759899

Method of Moments Grain Size Analysis
RMA 33080
Sample 70.25-71.25

Phi Class Midpoint	Wt (g)	Wt %	Midpt*Wt%	Deviation Mpt-Mean
-2.5	63.9	9.87	-24.66	-2.19
-1.5	139	21.46	-32.19	-1.19
-0.5	176.6	27.27	-13.63	-0.19
0.5	173.9	26.85	13.42	0.81
1.5	72.4	11.18	16.77	1.81
2.5	16.4	2.53	6.33	2.81
3.5	3.3	0.51	1.78	3.81
4.5	2.2	0.34	1.53	4.81
	647.7	100	-30.65	

Phi Class Midpoint	Dev*2	Wt%*Dev*2	Wt%*Dev*3	Wt%*Dev*4
-2.5	4.81	47.47	-104.11	228.37
-1.5	1.42	30.57	-36.48	43.54
-0.5	0.04	1.02	-0.20	0.04
0.5	0.65	17.47	14.09	11.36
1.5	3.26	36.48	65.90	119.06
2.5	7.88	19.94	55.97	157.09
3.5	14.49	7.38	28.10	106.97
4.5	23.10	7.85	37.72	181.29
		168.17	60.99	847.72

First Moment:
Mean = Sum(Wt%*Midpt)/100
= -0.306546

Second Moment:
Dispersion= Sum((Wt%)*(Dev*2))/100
= 1.6817357

Square Root of Second Moment:
Standard Deviation= 1.2968175

Third Moment = Sum((Wt%)*(Dev*3))/100
= 0.6099216
Skewness = Third Moment/(Standard deviation*3)
= 0.2796645

Fourth Moment = Sum((Wt%)*(Dev*4))/100
= 8.4772439
Kurtosis = Fourth Moment/(Standard Deviation*4)
=2.9973618

Method of Moments Grain Size Analysis
RMA 33080
Sample 71.25-72

Phi Class Midpoint	Wt (g)	Wt %	Midpt*Wt%	Deviation Mpt-Mean
-2.5	13.5	4.63	-11.57	-2.59
-1.5	33.6	11.51	-17.27	-1.59
-0.5	118.4	40.58	-20.29	-0.59
0.5	73.8	25.29	12.65	0.41
1.5	26.1	8.94	13.42	1.41
2.5	5	1.71	4.28	2.41
3.5	15	5.14	17.99	3.41
4.5	6.4	2.19	9.87	4.41
	291.8	100	9.08	

Phi Class Midpoint	Dev*2	Wt%*Dev*2	Wt%*Dev*3	Wt%*Dev*4
-2.5	6.71	31.05	-80.46	208.45
-1.5	2.53	29.14	-46.36	73.75
-0.5	0.35	14.16	-8.37	4.94
0.5	0.17	4.23	1.73	0.71
1.5	1.99	17.76	25.03	35.27
2.5	5.80	9.95	23.96	57.73
3.5	11.62	59.75	203.68	694.40
4.5	19.44	42.64	188.01	828.95
		208.69	307.23	1904.19

First Moment:
Mean = Sum(Wt%*Midpt)/100
= 0.0908156

Second Moment:
Dispersion= Sum((Wt%)*(Dev*2))/100
= 2.0868519

Square Root of Second Moment:
Standard Deviation= 1.4445940

Third Moment = Sum((Wt%)*(Dev*3))/100
= 3.0723156
Skewness = Third Moment/(Standard deviation*3)
= 1.0191271

Fourth Moment = Sum((Wt%)*(Dev*4))/100
= 19.041873
Kurtosis = Fourth Moment/(Standard Deviation*4)
=4.3724657

Method of Moments Grain Size Analysis

RMA 33080

Sample	74-75			Deviation
Phi Class Midpoint	Wt (g)	Wt %	Midpt*Wt%	Mpt-Mean
-2.5	41.8	7.04	-17.60	-2.79
-1.5	86.5	14.57	-21.85	-1.79
-0.5	121	20.38	-10.19	-0.79
0.5	158	26.61	13.31	0.21
1.5	109.4	18.43	27.64	1.21
2.5	50.7	8.54	21.35	2.21
3.5	20.4	3.44	12.03	3.21
4.5	5.9	0.99	4.47	4.21
	593.7	100	29.15	

Phi Class Midpoint	Dev*2	Wt%*Dev*2	Wt%*Dev*3	Wt%*Dev*4
-2.5	7.79	54.86	-153.15	427.51
-1.5	3.21	46.76	-83.77	150.07
-0.5	0.63	12.77	-10.10	8.00
0.5	0.04	1.16	0.24	0.05
1.5	1.46	26.91	32.52	39.31
2.5	4.88	41.65	91.99	203.16
3.5	10.29	35.37	113.50	364.15
4.5	17.71	17.60	74.08	311.75
		237.09	65.31	1504.00

First Moment:
Mean = Sum(Wt%*Midpt)/100
= 0.2914771

Second Moment:
Dispersion= Sum((Wt%)*(Dev*2))/100
= 2.3708689

Square Root of Second Moment:
Standard Deviation= 1.5397626

Third Moment = Sum((Wt%)*(Dev*3))/100
= 0.6530634

Skewness = Third Moment/(Standard deviation*3)
= 0.1788932

Fourth Moment = Sum((Wt%)*(Dev*4))/100
= 15.040001

Kurtosis = Fourth Moment/(Standard Deviation*4)
=2.6756714

Method of Moments Grain Size Analysis
RMA 33080
Sample 75-76

Phi Class Midpoint	Wt (g)	Wt %	Midpt*Wt%	Deviation Mpt-Mean
-2.5	104.8	10.89	-27.22	-2.72
-1.5	49.1	5.10	-7.65	-1.72
-0.5	166.4	17.29	-8.65	-0.72
0.5	402.8	41.85	20.93	0.28
1.5	193.2	20.07	30.11	1.28
2.5	30.6	3.18	7.95	2.28
3.5	8.7	0.90	3.16	3.28
4.5	6.8	0.71	3.18	4.28
	962.4	100	21.81	

Phi Class Midpoint	Dev*2	Wt%*Dev*2	Wt%*Dev*3	Wt%*Dev*4
-2.5	7.39	80.45	-218.68	594.38
-1.5	2.95	15.06	-25.87	44.45
-0.5	0.52	8.92	-6.40	4.60
0.5	0.08	3.33	0.94	0.26
1.5	1.64	32.99	42.29	54.21
2.5	5.21	16.56	37.78	86.21
3.5	10.77	9.74	31.96	104.87
4.5	18.33	12.95	55.47	237.52
		179.99	-82.52	1126.51

First Moment:
Mean = Sum(Wt%*Midpt)/100
= 0.2181005

Second Moment:
Dispersion= Sum((Wt%)*(Dev*2))/100
= 1.7998968

Square Root of Second Moment:
Standard Deviation= 1.3416023

Third Moment = Sum((Wt%)*(Dev*3))/100
= -0.825233
Skewness = Third Moment/(Standard deviation*3)
= -0.341747

Fourth Moment = Sum((Wt%)*(Dev*4))/100
= 11.265118
Kurtosis = Fourth Moment/(Standard Deviation*4)
= 3.4772871

Method of Moments Grain Size Analysis
RMA 33080
Sample 76-77

Phi Class Midpoint	Wt (g)	Wt %	Midpt*Wt%	Deviation Mpt-Mean
-2.5	26.3	4.07	-10.16	-2.99
-1.5	40.8	6.31	-9.46	-1.99
-0.5	107.8	16.66	-8.33	-0.99
0.5	275.4	42.57	21.29	0.01
1.5	149	23.03	34.55	1.01
2.5	32.4	5.01	12.52	2.01
3.5	9.8	1.51	5.30	3.01
4.5	5.4	0.83	3.76	4.01
	646.9	100	49.46	

Phi Class Midpoint	Dev*2	Wt%*Dev*2	Wt%*Dev*3	Wt%*Dev*4
-2.5	8.97	36.46	-109.18	326.94
-1.5	3.98	25.09	-50.05	99.82
-0.5	0.99	16.48	-16.40	16.31
0.5	0.00	0.00	0.00	0.00
1.5	1.01	23.28	23.41	23.54
2.5	4.02	20.14	40.39	81.01
3.5	9.03	13.68	41.12	123.60
4.5	16.04	13.39	53.64	214.85
		148.54	-17.05	886.06

First Moment:
Mean = Sum(Wt%*Midpt)/100
= 0.4945895

Second Moment:
Dispersion= Sum((Wt%)*(Dev*2))/100
= 1.4853625

Square Root of Second Moment:
Standard Deviation= 1.2187545

Third Moment = Sum((Wt%)*(Dev*3))/100
= -0.170511
Skewness = Third Moment/(Standard deviation*3)
= -0.094189

Fourth Moment = Sum((Wt%)*(Dev*4))/100
= 8.8606339
Kurtosis = Fourth Moment/(Standard Deviation*4)
=4.0160566

Method of Moments Grain Size Analysis
RMA 33080
Sample 77-78

Phi Class Midpoint	Wt (g)	Wt %	Midpt*Wt%	Deviation Mpt-Mean
-2.5	13.2	1.80	-4.49	-3.22
-1.5	23	3.13	-4.70	-2.22
-0.5	108.3	14.75	-7.37	-1.22
0.5	344.4	46.90	23.45	-0.22
1.5	177	24.10	36.16	0.78
2.5	40	5.45	13.62	1.78
3.5	15.4	2.10	7.34	2.78
4.5	13	1.77	7.97	3.78
	734.3	100	71.97	

Phi Class Midpoint	Dev*2	Wt%*Dev*2	Wt%*Dev*3	Wt%*Dev*4
-2.5	10.37	18.63	-60.00	193.17
-1.5	4.93	15.43	-34.25	76.03
-0.5	1.49	21.94	-26.76	32.64
0.5	0.05	2.26	-0.50	0.11
1.5	0.61	14.68	11.45	8.94
2.5	3.17	17.27	30.74	54.73
3.5	7.73	16.21	45.08	125.32
4.5	14.29	25.30	95.64	361.57
		131.73	61.40	852.51

First Moment:
Mean = Sum(Wt%*Midpt)/100
= 0.7196649

Second Moment:
Dispersion= Sum((Wt%)*(Dev*2))/100
= 1.3172654

Square Root of Second Moment:
Standard Deviation= 1.1477218

Third Moment = Sum((Wt%)*(Dev*3))/100
= 0.6140434
Skewness = Third Moment/(Standard deviation*3)
= 0.4061524

Fourth Moment = Sum((Wt%)*(Dev*4))/100
= 8.5250847
Kurtosis = Fourth Moment/(Standard Deviation*4)
= 4.9130601

Method of Moments Grain Size Analysis
RMA 33080
Sample 78-79

Phi Class Midpoint	Wt (g)	Wt %	Midpt*Wt%	Deviation Mpt-Mean
-2.5	4.4	0.83	-2.08	-3.20
-1.5	13.4	2.54	-3.80	-2.20
-0.5	96.7	18.30	-9.15	-1.20
0.5	247.3	46.79	23.40	-0.20
1.5	118.5	22.42	33.63	0.80
2.5	28.7	5.43	13.58	1.80
3.5	11.4	2.16	7.55	2.80
4.5	8.1	1.53	6.90	3.80
	528.5	100	70.02	

Phi Class Midpoint	Dev*2	Wt%*Dev*2	Wt%*Dev*3	Wt%*Dev*4
-2.5	10.24	8.53	-27.29	87.32
-1.5	4.84	12.27	-27.00	59.42
-0.5	1.44	26.36	-31.63	37.96
0.5	0.04	1.88	-0.38	0.08
1.5	0.64	14.34	11.47	9.18
2.5	3.24	17.59	31.66	56.98
3.5	7.84	16.91	47.34	132.55
4.5	14.44	22.13	84.09	319.51
		120.00	88.26	702.99

First Moment:
Mean = Sum(Wt%*Midpt)/100
= 0.7001892

Second Moment:
Dispersion= Sum((Wt%)*(Dev*2))/100
= 1.2000378

Square Root of Second Moment:
Standard Deviation= 1.0954623

Third Moment = Sum((Wt%)*(Dev*3))/100
= 0.8826262
Skewness = Third Moment/(Standard deviation*3)
= 0.6714048

Fourth Moment = Sum((Wt%)*(Dev*4))/100
= 7.0299390
Kurtosis = Fourth Moment/(Standard Deviation*4)
= 4.8815945

Method of Moments Grain Size Analysis
RMA 33080
Sample 79-80

Phi Class Midpoint	Wt (g)	Wt %	Midpt*Wt%	Deviation Mpt-Mean
-2.5	0.5	0.07	-0.19	-3.83
-1.5	3.9	0.58	-0.88	-2.83
-0.5	33.6	5.03	-2.52	-1.83
0.5	246.6	36.94	18.47	-0.83
1.5	231.3	34.65	51.98	0.17
2.5	103.3	15.48	38.69	1.17
3.5	35.5	5.32	18.61	2.17
4.5	12.8	1.92	8.63	3.17
	667.5	100	132.80	

Phi Class Midpoint	Dev*2	Wt%*Dev*2	Wt%*Dev*3	Wt%*Dev*4
-2.5	14.65	1.10	-4.20	16.08
-1.5	8.00	4.67	-13.21	37.37
-0.5	3.34	16.82	-30.75	56.21
0.5	0.69	25.33	-20.97	17.37
1.5	0.03	1.02	0.18	0.03
2.5	1.37	21.26	24.91	29.20
3.5	4.72	25.09	54.49	118.36
4.5	10.06	19.29	61.20	194.13
		114.59	71.64	468.74

First Moment:
Mean = Sum(Wt%*Midpt)/100
= 1.3280149

Second Moment:
Dispersion= Sum((Wt%)*(Dev*2))/100
= 1.1458518

Square Root of Second Moment:
Standard Deviation= 1.0704447

Third Moment = Sum((Wt%)*(Dev*3))/100
= 0.7164449
Skewness = Third Moment/(Standard deviation*3)
= 0.5841039

Fourth Moment = Sum((Wt%)*(Dev*4))/100
= 4.6874399
Kurtosis = Fourth Moment/(Standard Deviation*4)
= 3.5700867

Method of Moments Grain Size Analysis
RMA 33080
Sample 80-81

Phi Class Midpoint	Wt (g)	Wt %	Midpt*Wt%	Deviation Mpt-Mean
-2.5	29.1	4.20	-10.51	-2.88
-1.5	46.1	6.66	-9.99	-1.88
-0.5	142.7	20.62	-10.31	-0.88
0.5	300.2	43.38	21.69	0.12
1.5	128.1	18.51	27.76	1.12
2.5	30.8	4.45	11.13	2.12
3.5	9.4	1.36	4.75	3.12
4.5	5.7	0.82	3.71	4.12
	692.1	100	38.22	

Phi Class Midpoint	Dev*2	Wt%*Dev*2	Wt%*Dev*3	Wt%*Dev*4
-2.5	8.31	34.93	-100.67	290.17
-1.5	3.54	23.60	-44.42	83.61
-0.5	0.78	16.05	-14.16	12.49
0.5	0.01	0.60	0.07	0.01
1.5	1.25	23.12	25.85	28.89
2.5	4.48	19.96	42.27	89.51
3.5	9.72	13.20	41.16	128.33
4.5	16.96	13.96	57.50	236.78
		145.43	7.60	869.79

First Moment:
Mean = Sum(Wt%*Midpt)/100
= 0.3822424

Second Moment:
Dispersion= Sum((Wt%)*(Dev*2))/100
= 1.4542736

Square Root of Second Moment:
Standard Deviation= 1.2059326

Third Moment = Sum((Wt%)*(Dev*3))/100
= 0.0760006
Skewness = Third Moment/(Standard deviation*3)
= 0.0433359

Fourth Moment = Sum((Wt%)*(Dev*4))/100
= 8.6978775
Kurtosis = Fourth Moment/(Standard Deviation*4)
= 4.1126433

Method of Moments Grain Size Analysis
RMA 33080
Sample 81-81.75

Phi Class Midpoint	Wt (g)	Wt %	Midpt*Wt%	Deviation Mpt-Mean
-2.5	100.2	18.58	-46.45	-2.08
-1.5	101.1	18.75	-28.12	-1.08
-0.5	126.3	23.42	-11.71	-0.08
0.5	126	23.36	11.68	0.92
1.5	55.5	10.29	15.44	1.92
2.5	17.3	3.21	8.02	2.92
3.5	7.6	1.41	4.93	3.92
4.5	5.3	0.98	4.42	4.92
	539.3	100	-41.79	

Phi Class Midpoint	Dev*2	Wt%*Dev*2	Wt%*Dev*3	Wt%*Dev*4
-2.5	4.34	80.55	-167.71	349.20
-1.5	1.17	21.95	-23.76	25.71
-0.5	0.01	0.16	-0.01	0.00
0.5	0.84	19.68	18.07	16.58
1.5	3.68	37.85	72.60	139.23
2.5	8.51	27.31	79.69	232.53
3.5	15.35	21.63	84.75	332.03
4.5	24.19	23.77	116.89	574.84
		232.91	180.51	1670.12

First Moment:
Mean = Sum(Wt%*Midpt)/100
= -0.417856

Second Moment:
Dispersion= Sum((Wt%)*(Dev*2))/100
= 2.3290581

Square Root of Second Moment:
Standard Deviation= 1.5261251

Third Moment = Sum((Wt%)*(Dev*3))/100
= 1.8050607
Skewness = Third Moment/(Standard deviation*3)
= 0.5078334

Fourth Moment = Sum((Wt%)*(Dev*4))/100
= 16.701217
Kurtosis = Fourth Moment/(Standard Deviation*4)
= 3.0788425

Method of Moments Grain Size Analysis
RMA 33080
Sample 81.75-82.75

Phi Class Midpoint	Wt (g)	Wt %	Midpt*Wt%	Deviation Mpt-Mean
-2.5	21.7	3.63	-9.06	-3.30
-1.5	22.7	3.79	-5.69	-2.30
-0.5	76.6	12.80	-6.40	-1.30
0.5	220.9	36.91	18.45	-0.30
1.5	181.3	30.29	45.44	0.70
2.5	50.7	8.47	21.18	1.70
3.5	16.1	2.69	9.42	2.70
4.5	8.5	1.42	6.39	3.70
	598.5	100	79.72	

Phi Class Midpoint	Dev*2	Wt%*Dev*2	Wt%*Dev*3	Wt%*Dev*4
-2.5	10.87	39.42	-129.97	428.55
-1.5	5.28	20.02	-45.98	105.63
-0.5	1.68	21.54	-27.94	36.25
0.5	0.09	3.26	-0.97	0.29
1.5	0.49	14.96	10.51	7.39
2.5	2.90	24.56	41.82	71.21
3.5	7.30	19.65	53.11	143.55
4.5	13.71	19.47	72.10	266.97
		162.88	-27.32	1059.82

First Moment:
Mean = Sum(Wt%*Midpt)/100
= 0.7972431

Second Moment:
Dispersion= Sum((Wt%)*(Dev*2))/100
= 1.6287726

Square Root of Second Moment:
Standard Deviation= 1.2762337

Third Moment = Sum((Wt%)*(Dev*3))/100
= -0.273173
Skewness = Third Moment/(Standard deviation*3)
= -0.131415

Fourth Moment = Sum((Wt%)*(Dev*4))/100
= 10.598237
Kurtosis = Fourth Moment/(Standard Deviation*4)
= 3.9949624

Method of Moments Grain Size Analysis
RMA 33080
Sample 82.75-83.75

Phi Class Midpoint	Wt (g)	Wt %	Midpt*Wt%	Deviation Mpt-Mean
-2.5	115.3	16.21	-40.54	-2.33
-1.5	91.4	12.85	-19.28	-1.33
-0.5	179.1	25.19	-12.59	-0.33
0.5	189.5	26.65	13.32	0.67
1.5	79.3	11.15	16.73	1.67
2.5	28.7	4.04	10.09	2.67
3.5	14.6	2.05	7.19	3.67
4.5	13.2	1.86	8.35	4.67
	711.1	100	-16.73	

Phi Class Midpoint	Dev*2	Wt%*Dev*2	Wt%*Dev*3	Wt%*Dev*4
-2.5	5.44	88.23	-205.82	480.12
-1.5	1.78	22.83	-30.43	40.55
-0.5	0.11	2.79	-0.93	0.31
0.5	0.45	11.87	7.92	5.28
1.5	2.78	31.00	51.69	86.17
2.5	7.11	28.71	76.59	204.28
3.5	13.45	27.61	101.26	371.36
4.5	21.78	40.44	188.73	880.84
		253.48	189.01	2068.92

First Moment:
Mean = Sum(Wt%*Midpt)/100
= -0.167276

Second Moment:
Dispersion= Sum((Wt%)*(Dev*2))/100
= 2.5347736

Square Root of Second Moment:
Standard Deviation= 1.5920972

Third Moment = Sum((Wt%)*(Dev*3))/100
= 1.8900644
Skewness = Third Moment/(Standard deviation*3)
= 0.4683471

Fourth Moment = Sum((Wt%)*(Dev*4))/100
= 20.689165
Kurtosis = Fourth Moment/(Standard Deviation*4)
= 3.2200649

Method of Moments Grain Size Analysis
RMA 33080
Sample 84-85.25

Phi Class Midpoint	Wt (g)	Wt %	Midpt*Wt%	Deviation Mpt-Mean
-2.5	8.4	1.29	-3.22	-3.41
-1.5	27.7	4.25	-6.37	-2.41
-0.5	84.5	12.95	-6.48	-1.41
0.5	224.5	34.41	17.20	-0.41
1.5	214.3	32.84	49.26	0.59
2.5	68.2	10.45	26.13	1.59
3.5	17	2.61	9.12	2.59
4.5	7.9	1.21	5.45	3.59
	652.5	100	91.10	

Phi Class Midpoint	Dev*2	Wt%*Dev*2	Wt%*Dev*3	Wt%*Dev*4
-2.5	11.64	14.98	-51.09	174.28
-1.5	5.81	24.68	-59.50	143.45
-0.5	1.99	25.78	-36.38	51.34
0.5	0.17	5.81	-2.39	0.98
1.5	0.35	11.39	6.71	3.95
2.5	2.52	26.39	41.93	66.63
3.5	6.70	17.46	45.21	117.05
4.5	12.88	15.59	55.97	200.87
		142.09	0.46	758.56

First Moment:
Mean = Sum(Wt%*Midpt)/100
= 0.9110344

Second Moment:
Dispersion= Sum((Wt%)*(Dev*2))/100
= 1.4209357

Square Root of Second Moment:
Standard Deviation= 1.1920300

Third Moment = Sum((Wt%)*(Dev*3))/100
= 0.0046021
Skewness = Third Moment/(Standard deviation*3)
= 0.0027170

Fourth Moment = Sum((Wt%)*(Dev*4))/100
= 7.5855615
Kurtosis = Fourth Moment/(Standard Deviation*4)
=3.7569799

Method of Moments Grain Size Analysis
RMA 33080
Sample 85.25-86.25

Phi Class Midpoint	Wt (g)	Wt %	Midpt*Wt%	Deviation Mpt-Mean
-2.5	78.2	12.23	-30.58	-2.76
-1.5	58.3	9.12	-13.68	-1.76
-0.5	101.5	15.87	-7.94	-0.76
0.5	199.7	31.23	15.62	0.24
1.5	133.3	20.85	31.27	1.24
2.5	47.6	7.44	18.61	2.24
3.5	13	2.03	7.12	3.24
4.5	7.8	1.22	5.49	4.24
	639.4	100	25.91	

Phi Class Midpoint	Dev*2	Wt%*Dev*2	Wt%*Dev*3	Wt%*Dev*4
-2.5	7.61	93.11	-256.90	708.82
-1.5	3.09	28.22	-49.64	87.32
-0.5	0.58	9.15	-6.95	5.27
0.5	0.06	1.81	0.44	0.11
1.5	1.54	32.10	39.83	49.42
2.5	5.02	37.38	83.77	187.71
3.5	10.50	21.35	69.21	224.29
4.5	17.98	21.94	93.04	394.58
		245.06	-27.20	1657.51

First Moment:
Mean = Sum(Wt%*Midpt)/100
= 0.2591492

Second Moment:
Dispersion= Sum((Wt%)*(Dev*2))/100
= 2.4505927

Square Root of Second Moment:
Standard Deviation= 1.5654369

Third Moment = Sum((Wt%)*(Dev*3))/100
= -0.271962
Skewness = Third Moment/(Standard deviation*3)
= -0.070892

Fourth Moment = Sum((Wt%)*(Dev*4))/100
= 16.575147
Kurtosis = Fourth Moment/(Standard Deviation*4)
= 2.7600384

Method of Moments Grain Size Analysis
RMA 33080
Sample 86.25-87.25

Phi Class Midpoint	Wt (g)	Wt %	Midpt*Wt%	Deviation Mpt-Mean
-2.5	28	5.41	-13.54	-3.44
-1.5	73.5	14.21	-21.32	-2.44
-0.5	84	16.24	-8.12	-1.44
0.5	76.1	14.72	7.36	-0.44
1.5	100.1	19.36	29.04	0.56
2.5	66.6	12.88	32.20	1.56
3.5	43.8	8.47	29.65	2.56
4.5	45	8.70	39.16	3.56
	517.1	100	94.42	

Phi Class Midpoint	Dev*2	Wt%*Dev*2	Wt%*Dev*3	Wt%*Dev*4
-2.5	11.86	64.23	-221.23	761.98
-1.5	5.97	84.92	-207.55	507.30
-0.5	2.09	33.88	-48.93	70.67
0.5	0.20	2.90	-1.29	0.57
1.5	0.31	5.98	3.32	1.85
2.5	2.42	31.17	48.50	75.46
3.5	6.53	55.33	141.41	361.41
4.5	12.64	110.03	391.24	1391.18
		388.45	105.47	3170.41

First Moment:
Mean = Sum(Wt%*Midpt)/100
= 0.9442080

Second Moment:
Dispersion= Sum((Wt%)*(Dev*2))/100
= 3.8844815

Square Root of Second Moment:
Standard Deviation= 1.9709088

Third Moment = Sum((Wt%)*(Dev*3))/100
= 1.0546880
Skewness = Third Moment/(Standard deviation*3)
= 0.1377604

Fourth Moment = Sum((Wt%)*(Dev*4))/100
= 31.704138
Kurtosis = Fourth Moment/(Standard Deviation*4)
=2.1011150

Method of Moments Grain Size Analysis

RMA 33080

Sample 87.25-88.5

Phi Class Midpoint	Wt (g)	Wt %	Midpt*Wt%	Deviation Mpt-Mean
-2.5	86.5	8.78	-21.94	-2.92
-1.5	194.4	19.73	-29.59	-1.92
-0.5	205.3	20.83	-10.42	-0.92
0.5	164.8	16.72	8.36	0.08
1.5	107.4	10.90	16.35	1.08
2.5	80.2	8.14	20.35	2.08
3.5	80.1	8.13	28.45	3.08
4.5	66.8	6.78	30.50	4.08
	985.5	100	42.05	

Phi Class Midpoint	Dev*2	Wt%*Dev*2	Wt%*Dev*3	Wt%*Dev*4
-2.5	8.53	74.87	-218.65	638.58
-1.5	3.69	72.76	-139.74	268.37
-0.5	0.85	17.65	-16.25	14.96
0.5	0.01	0.11	0.01	0.00
1.5	1.17	12.70	13.71	14.80
2.5	4.32	35.19	73.18	152.16
3.5	9.48	77.08	237.35	730.92
4.5	16.64	112.80	460.18	1877.27
		403.15	409.78	3697.07

First Moment:
Mean = Sum(Wt%*Midpt)/100
= 0.4205479

Second Moment:
Dispersion= Sum((Wt%)*(Dev*2))/100
= 4.0315361

Square Root of Second Moment:
Standard Deviation= 2.0078685

Third Moment = Sum((Wt%)*(Dev*3))/100
= 4.0978205
Skewness = Third Moment/(Standard deviation*3)
= 0.5062290

Fourth Moment = Sum((Wt%)*(Dev*4))/100
= 36.970689
Kurtosis = Fourth Moment/(Standard Deviation*4)
=2.2746596

Method of Moments Grain Size Analysis
RMA Core 2
Sample 56.5-57.5

Phi Class Midpoint	Wt (g)	Wt %	Midpt*Wt%	Deviation Mpt-Mean
-5.5	0	0.00	0.00	-5.99
-4.5	0	0.00	0.00	-4.99
-3.5	18.62	2.45	-8.59	-3.99
-2.5	34.09	4.49	-11.23	-2.99
-1.5	62.6	8.25	-12.37	-1.99
-0.5	127.6	16.81	-8.40	-0.99
0.5	251.6	33.14	16.57	0.01
1.5	166.2	21.89	32.84	1.01
2.5	58.2	7.67	19.17	2.01
3.5	24.9	3.28	11.48	3.01
4.5	15.3	2.02	9.07	4.01
	759.11	100	48.54	

Phi Class Midpoint	Dev*2	Wt%*Dev*2	Wt%*Dev*3	Wt%*Dev*4
-5.5	35.83	0.00	0.00	0.00
-4.5	24.85	0.00	0.00	0.00
-3.5	15.88	38.96	-155.28	618.84
-2.5	8.91	40.03	-119.49	356.74
-1.5	3.94	32.51	-64.54	128.14
-0.5	0.97	16.32	-16.09	15.85
0.5	0.00	0.01	0.00	0.00
1.5	1.03	22.54	22.86	23.20
2.5	4.06	31.12	62.68	126.28
3.5	9.09	29.81	89.86	270.89
4.5	16.12	32.48	130.41	523.52
		243.77	-49.58	2063.47

First Moment:
Mean = Sum(Wt%*Midpt)/100
= 0.4854434

Second Moment:
Dispersion= Sum((Wt%)*(Dev*2))/100
= 2.4376824
Square Root of Second Moment:
Standard Deviation= 1.5613079

Third Moment = Sum((Wt%)*(Dev*3))/100
= -0.495841
Skewness = Third Moment/(Standard deviation*3)
= -0.130279

Fourth Moment = Sum((Wt%)*(Dev*4))/100
= 20.634744
Kurtosis = Fourth Moment/(Standard Deviation*4)
=3.4725205

Method of Moments Grain Size Analysis
RMA Core 2
Sample 57.5-58.5

Phi Class Midpoint	Wt (g)	Wt %	Midpt*Wt%	Deviation Mpt-Mean
-5.5	0	0.00	0.00	-5.44
-4.5	6.3	0.90	-4.07	-4.44
-3.5	20.2	2.90	-10.14	-3.44
-2.5	57.1	8.19	-20.47	-2.44
-1.5	84.1	12.06	-18.09	-1.44
-0.5	146	20.93	-10.47	-0.44
0.5	245.3	35.17	17.59	0.56
1.5	97	13.91	20.86	1.56
2.5	23.5	3.37	8.42	2.56
3.5	10.1	1.45	5.07	3.56
4.5	7.8	1.12	5.03	4.56
	697.4	100	-6.25	

Phi Class Midpoint	Dev*2	Wt%*Dev*2	Wt%*Dev*3	Wt%*Dev*4
-5.5	29.57	0.00	0.00	0.00
-4.5	19.69	17.79	-78.93	350.27
-3.5	11.82	34.23	-117.65	404.42
-2.5	5.94	48.64	-118.57	289.01
-1.5	2.07	24.92	-35.82	51.49
-0.5	0.19	4.01	-1.75	0.77
0.5	0.32	11.13	6.26	3.52
1.5	2.44	33.96	53.06	82.91
2.5	6.57	22.13	56.70	145.30
3.5	12.69	18.38	65.48	233.27
4.5	20.82	23.28	106.22	484.65
		238.46	-65.00	2045.61

First Moment:
Mean = Sum(Wt%*Midpt)/100
= -0.062517

Second Moment:
Dispersion= Sum((Wt%)*(Dev*2))/100
= 2.3846059
Square Root of Second Moment:
Standard Deviation= 1.5442169

Third Moment = Sum((Wt%)*(Dev*3))/100
= -0.650018
Skewness = Third Moment/(Standard deviation*3)
= -0.176522

Fourth Moment = Sum((Wt%)*(Dev*4))/100
= 20.456142
Kurtosis = Fourth Moment/(Standard Deviation*4)
= 3.5974145

Method of Moments Grain Size Analysis
RMA Core 2
Sample 58.5-59.5

Phi Class Midpoint	Wt (g)	Wt %	Midpt*Wt%	Deviation Mpt-Mean
-5.5	0	0.00	0.00	-5.04
-4.5	19.3	2.78	-12.49	-4.04
-3.5	32.8	4.72	-16.51	-3.04
-2.5	65.5	9.42	-23.55	-2.04
-1.5	103.7	14.91	-22.37	-1.04
-0.5	177.8	25.57	-12.78	-0.04
0.5	202.1	29.06	14.53	0.96
1.5	66.6	9.58	14.37	1.96
2.5	14.7	2.11	5.28	2.96
3.5	6.9	0.99	3.47	3.96
4.5	6	0.86	3.88	4.96
	695.4	100	-46.16	

Phi Class Midpoint	Dev*2	Wt%*Dev*2	Wt%*Dev*3	Wt%*Dev*4
-5.5	25.39	0.00	0.00	0.00
-4.5	16.31	45.26	-182.79	738.17
-3.5	9.23	43.54	-132.30	401.99
-2.5	4.16	39.14	-79.78	162.61
-1.5	1.08	16.08	-16.70	17.34
-0.5	0.00	0.04	-0.00	0.00
0.5	0.92	26.87	25.84	24.85
1.5	3.85	36.85	72.29	141.80
2.5	8.77	18.54	54.91	162.63
3.5	15.69	15.57	61.69	244.40
4.5	24.62	21.24	105.39	522.88
		263.14	-91.45	2416.68

First Moment:
Mean = Sum(Wt%*Midpt)/100
= -0.461604

Second Moment:
Dispersion= Sum((Wt%)*(Dev*2))/100
= 2.6313989
Square Root of Second Moment:
Standard Deviation= 1.6221587

Third Moment = Sum((Wt%)*(Dev*3))/100
= -0.914458
Skewness = Third Moment/(Standard deviation*3)
= -0.214231

Fourth Moment = Sum((Wt%)*(Dev*4))/100
= 24.166777
Kurtosis = Fourth Moment/(Standard Deviation*4)
= 3.4901600

Method of Moments Grain Size Analysis
RMA Core 2
Sample 59.5-60.5

Phi Class Midpoint	Wt (g)	Wt %	Midpt*Wt%	Deviation Mpt-Mean
-5.5	0	0.00	0.00	-4.47
-4.5	48.5	7.10	-31.95	-3.47
-3.5	40.9	5.99	-20.96	-2.47
-2.5	104.4	15.29	-38.21	-1.47
-1.5	149.7	21.92	-32.88	-0.47
-0.5	144.1	21.10	-10.55	0.53
0.5	121	17.72	8.86	1.53
1.5	49.8	7.29	10.94	2.53
2.5	13.7	2.01	5.01	3.53
3.5	6.4	0.94	3.28	4.53
4.5	4.5	0.66	2.96	5.53
	683	100	-103.50	

Phi Class Midpoint	Dev*2	Wt%*Dev*2	Wt%*Dev*3	Wt%*Dev*4
-5.5	19.94	0.00	0.00	0.00
-4.5	12.01	85.26	-295.42	1023.62
-3.5	6.08	36.39	-89.69	221.09
-2.5	2.15	32.81	-48.06	70.41
-1.5	0.22	4.74	-2.20	1.02
-0.5	0.29	6.04	3.23	1.73
0.5	2.36	41.74	64.07	98.35
1.5	6.43	46.86	118.78	301.10
2.5	12.50	25.07	88.61	313.22
3.5	20.57	19.27	87.40	396.34
4.5	30.64	20.18	111.72	618.39
		318.35	38.43	3045.28

First Moment:
Mean = Sum(Wt%*Midpt)/100
= -1.034992

Second Moment:
Dispersion= Sum((Wt%)*(Dev*2))/100
= 3.1834753
Square Root of Second Moment:
Standard Deviation= 1.7842296

Third Moment = Sum((Wt%)*(Dev*3))/100
= 0.3843476
Skewness = Third Moment/(Standard deviation*3)
= 0.0676662

Fourth Moment = Sum((Wt%)*(Dev*4))/100
= 30.452790
Kurtosis = Fourth Moment/(Standard Deviation*4)
= 3.0048590

Method of Moments Grain Size Analysis
RMA Core 2
Sample 60.5-61.5

Phi Class Midpoint	Wt (g)	Wt %	Midpt*Wt%	Deviation Mpt-Mean
-5.5	0	0.00	0.00	-4.90
-4.5	17.8	3.09	-13.90	-3.90
-3.5	27.2	4.72	-16.52	-2.90
-2.5	77.1	13.38	-33.46	-1.90
-1.5	103.6	17.98	-26.97	-0.90
-0.5	132.6	23.02	-11.51	0.10
0.5	130.4	22.63	11.32	1.10
1.5	55.3	9.60	14.40	2.10
2.5	19.4	3.37	8.42	3.10
3.5	7.6	1.32	4.62	4.10
4.5	5.1	0.89	3.98	5.10
	576.1	100	-59.63	

Phi Class Midpoint	Dev*2	Wt%*Dev*2	Wt%*Dev*3	Wt%*Dev*4
-5.5	24.05	0.00	0.00	0.00
-4.5	15.24	47.08	-183.80	717.48
-3.5	8.43	39.81	-115.59	335.63
-2.5	3.62	48.50	-92.33	175.76
-1.5	0.82	14.69	-13.27	11.99
-0.5	0.01	0.21	0.02	0.00
0.5	1.20	27.21	29.83	32.70
1.5	4.39	42.18	88.43	185.38
2.5	9.59	32.28	99.97	309.53
3.5	16.78	22.14	90.68	371.45
4.5	25.97	22.99	117.18	597.18
		297.09	21.12	2737.10

First Moment:
Mean = Sum(Wt%*Midpt)/100
= -0.596337

Second Moment:
Dispersion= Sum((Wt%)*(Dev*2))/100
= 2.9709308
Square Root of Second Moment:
Standard Deviation= 1.7236388

Third Moment = Sum((Wt%)*(Dev*3))/100
= 0.2112047
Skewness = Third Moment/(Standard deviation*3)
= 0.0412443

Fourth Moment = Sum((Wt%)*(Dev*4))/100
= 27.370993
Kurtosis = Fourth Moment/(Standard Deviation*4)
= 3.1010264

Method of Moments Grain Size Analysis
RMA Core 2
Sample 64-65

Phi Class Midpoint	Wt (g)	Wt %	Midpt*Wt%	Deviation Mpt-Mean
-2.5	29.2	4.15	-10.36	-2.75
-1.5	93.9	13.33	-20.00	-1.75
-0.5	189	26.84	-13.42	-0.75
0.5	211.5	30.03	15.01	0.25
1.5	110.2	15.65	23.47	1.25
2.5	43.1	6.12	15.30	2.25
3.5	18	2.56	8.95	3.25
4.5	9.4	1.33	6.01	4.25
	704.3	100	24.95	

Phi Class Midpoint	Dev*2	Wt%*Dev*2	Wt%*Dev*3	Wt%*Dev*4
-2.5	7.56	31.34	-86.18	236.95
-1.5	3.06	40.81	-71.40	124.91
-0.5	0.56	15.08	-11.30	8.47
0.5	0.06	1.88	0.47	0.12
1.5	1.56	24.47	30.59	38.26
2.5	5.06	30.99	69.75	156.97
3.5	10.57	27.00	87.77	285.30
4.5	18.07	24.11	102.49	435.63
		195.69	122.20	1286.60

First Moment:
Mean = Sum(Wt%*Midpt)/100
= 0.2495385

Second Moment:
Dispersion= Sum((Wt%)*(Dev*2))/100
= 1.9568629
Square Root of Second Moment:
Standard Deviation= 1.3988791

Third Moment = Sum((Wt%)*(Dev*3))/100
= 1.2219759
Skewness = Third Moment/(Standard deviation*3)
= 0.4463977

Fourth Moment = Sum((Wt%)*(Dev*4))/100
= 12.865984
Kurtosis = Fourth Moment/(Standard Deviation*4)
= 3.3598678

Method of Moments Grain Size Analysis
RMA Core 2
Sample 65-66

Phi Class Midpoint	Wt (g)	Wt %	Midpt*Wt%	Deviation Mpt-Mean
-5.5	0	0.00	0.00	-4.44
-4.5	38.4	5.43	-24.43	-3.44
-3.5	46.7	6.60	-23.11	-2.44
-2.5	121.9	17.23	-43.09	-1.44
-1.5	154	21.77	-32.66	-0.44
-0.5	158.7	22.44	-11.22	0.56
0.5	119.9	16.95	8.48	1.56
1.5	40.9	5.78	8.67	2.56
2.5	16.1	2.28	5.69	3.56
3.5	6.3	0.89	3.12	4.56
4.5	4.4	0.62	2.80	5.56
	707.3	100	-105.75	

Phi Class Midpoint	Dev*2	Wt%*Dev*2	Wt%*Dev*3	Wt%*Dev*4
-5.5	19.74	0.00	0.00	0.00
-4.5	11.85	64.34	-221.49	762.50
-3.5	5.97	39.39	-96.21	235.00
-2.5	2.08	35.86	-51.73	74.63
-1.5	0.20	4.26	-1.89	0.83
-0.5	0.31	6.97	3.89	2.17
0.5	2.43	41.12	64.04	99.75
1.5	6.54	37.82	96.73	247.38
2.5	12.66	28.81	102.48	364.58
3.5	20.77	18.50	84.32	384.27
4.5	30.89	19.21	106.78	593.41
		296.29	86.91	2764.51

First Moment:
Mean = Sum(Wt%*Midpt)/100
= -1.057472

Second Moment:
Dispersion= Sum((Wt%)*(Dev*2))/100
= 2.9629418
Square Root of Second Moment:
Standard Deviation= 1.7213197

Third Moment = Sum((Wt%)*(Dev*3))/100
= 0.8690831
Skewness = Third Moment/(Standard deviation*3)
= 0.1704027

Fourth Moment = Sum((Wt%)*(Dev*4))/100
= 27.645099
Kurtosis = Fourth Moment/(Standard Deviation*4)
= 3.1489944

Method of Moments Grain Size Analysis
RMA Core 2
Sample 66-67

Phi Class Midpoint	Wt (g)	Wt %	Midpt*Wt%	Deviation Mpt-Mean
-5.5	0	0.00	0.00	-3.81
-4.5	21.6	3.03	-13.63	-2.81
-3.5	123.2	17.28	-60.47	-1.81
-2.5	200.4	28.10	-70.26	-0.81
-1.5	167.2	23.45	-35.17	0.19
-0.5	98.5	13.81	-6.91	1.19
0.5	57.8	8.11	4.05	2.19
1.5	24.7	3.46	5.20	3.19
2.5	11.5	1.61	4.03	4.19
3.5	4.8	0.67	2.36	5.19
4.5	3.4	0.48	2.15	6.19
	713.1	100	-168.65	

Phi Class Midpoint	Dev*2	Wt%*Dev*2	Wt%*Dev*3	Wt%*Dev*4
-5.5	14.54	0.00	0.00	0.00
-4.5	7.92	23.98	-67.46	189.80
-3.5	3.29	56.82	-103.04	186.86
-2.5	0.66	18.60	-15.13	12.31
-1.5	0.03	0.82	0.15	0.03
-0.5	1.41	19.45	23.07	27.38
0.5	4.78	38.75	84.73	185.26
1.5	10.15	35.17	112.07	357.11
2.5	17.53	28.27	118.33	495.40
3.5	26.90	18.11	93.91	487.07
4.5	38.27	18.25	112.89	698.41
		258.20	359.53	2639.63

First Moment:
Mean = Sum(Wt%*Midpt)/100
= -1.686509

Second Moment:
Dispersion= Sum((Wt%)*(Dev*2))/100
= 2.5819579

Square Root of Second Moment:
Standard Deviation= 1.6068472

Third Moment = Sum((Wt%)*(Dev*3))/100
= 3.5953270

Skewness = Third Moment/(Standard deviation*3)
= 0.8665919

Fourth Moment = Sum((Wt%)*(Dev*4))/100
= 26.396250

Kurtosis = Fourth Moment/(Standard Deviation*4)
= 3.9595324

Method of Moments Grain Size Analysis
RMA Core 2
Sample 67-68

Phi Class Midpoint	Wt (g)	Wt %	Midpt*Wt%	Deviation Mpt-Mean
-5.5	0	0.00	0.00	-4.44
-4.5	0	0.00	0.00	-3.44
-3.5	0	0.00	0.00	-2.44
-2.5	218.3	32.36	-80.89	-1.44
-1.5	178.4	26.44	-39.66	-0.44
-0.5	132.9	19.70	-9.85	0.56
0.5	87.2	12.92	6.46	1.56
1.5	35	5.19	7.78	2.56
2.5	13.9	2.06	5.15	3.56
3.5	5.3	0.79	2.75	4.56
4.5	3.7	0.55	2.47	5.56
	674.7	100	-105.79	

Phi Class Midpoint	Dev*2	Wt%*Dev*2	Wt%*Dev*3	Wt%*Dev*4
-5.5	19.73	0.00	0.00	0.00
-4.5	11.85	0.00	0.00	0.00
-3.5	5.96	0.00	0.00	0.00
-2.5	2.08	67.29	-97.04	139.94
-1.5	0.20	5.17	-2.29	1.01
-0.5	0.31	6.13	3.42	1.91
0.5	2.43	31.37	48.87	76.13
1.5	6.54	33.94	86.82	222.06
2.5	12.66	26.08	92.78	330.12
3.5	20.77	16.32	74.38	339.01
4.5	30.89	16.94	94.15	523.27
		203.23	301.09	1633.45

First Moment:
Mean = Sum(Wt%*Midpt)/100
= -1.057877

Second Moment:
Dispersion= Sum((Wt%)*(Dev*2))/100
= 2.0323327
Square Root of Second Moment:
Standard Deviation= 1.4255990

Third Moment = Sum((Wt%)*(Dev*3))/100
= 3.0109027
Skewness = Third Moment/(Standard deviation*3)
= 1.0392128

Fourth Moment = Sum((Wt%)*(Dev*4))/100
= 16.334525
Kurtosis = Fourth Moment/(Standard Deviation*4)
= 3.9547306

Method of Moments Grain Size Analysis
RMA 33085
Sample 58.5-59.75

Phi Class Midpoint	Wt (g)	Wt %	Midpt*Wt%	Deviation Mpt-Mean
-5.5	0	0.00	0.00	-5.42
-4.5	9.7	1.12	-5.03	-4.42
-3.5	43	4.96	-17.36	-3.42
-2.5	46.7	5.39	-13.46	-2.42
-1.5	97.3	11.22	-16.83	-1.42
-0.5	183.4	21.15	-10.58	-0.42
0.5	305.2	35.20	17.60	0.58
1.5	141.1	16.27	24.41	1.58
2.5	29.9	3.45	8.62	2.58
3.5	7	0.81	2.83	3.58
4.5	3.8	0.44	1.97	4.58
	867.1	100	-7.84	

Phi Class Midpoint	Dev*2	Wt%*Dev*2	Wt%*Dev*3	Wt%*Dev*4
-5.5	29.39	0.00	0.00	0.00
-4.5	19.55	21.87	-96.71	427.60
-3.5	11.71	58.06	-198.66	679.73
-2.5	5.86	31.58	-76.48	185.22
-1.5	2.02	22.68	-32.24	45.83
-0.5	0.18	3.76	-1.59	0.67
0.5	0.33	11.77	6.81	3.94
1.5	2.49	40.54	63.99	100.99
2.5	6.65	22.92	59.11	152.40
3.5	12.80	10.34	36.99	132.36
4.5	20.96	9.19	42.06	192.56
		232.71	-196.72	1921.29

First Moment:
Mean = Sum(Wt%*Midpt)/100
= -0.078364

Second Moment:
Dispersion= Sum((Wt%)*(Dev*2))/100
= 2.3271250
Square Root of Second Moment:
Standard Deviation= 1.5254917

Third Moment = Sum((Wt%)*(Dev*3))/100
= -1.967230
Skewness = Third Moment/(Standard deviation*3)
= -0.554147

Fourth Moment = Sum((Wt%)*(Dev*4))/100
= 19.212914
Kurtosis = Fourth Moment/(Standard Deviation*4)
= 3.5477564

Method of Moments Grain Size Analysis
RMA 33085
Sample 59.75-61

Phi Class Midpoint	Wt (g)	Wt %	Midpt*Wt%	Deviation Mpt-Mean
-5.5	0	0.00	0.00	-5.43
-4.5	64	7.02	-31.60	-4.43
-3.5	31	3.40	-11.90	-3.43
-2.5	33.1	3.63	-9.08	-2.43
-1.5	66.9	7.34	-11.01	-1.43
-0.5	165	18.10	-9.05	-0.43
0.5	311.7	34.20	17.10	0.57
1.5	184.9	20.29	30.43	1.57
2.5	37.1	4.07	10.18	2.57
3.5	10.6	1.16	4.07	3.57
4.5	7.1	0.78	3.51	4.57
	911.4	100	-7.36	

Phi Class Midpoint	Dev*2	Wt%*Dev*2	Wt%*Dev*3	Wt%*Dev*4
-5.5	29.45	0.00	0.00	0.00
-4.5	19.59	137.58	-609.00	2695.66
-3.5	11.74	39.93	-136.82	468.81
-2.5	5.89	21.38	-51.88	125.88
-1.5	2.03	14.93	-21.30	30.38
-0.5	0.18	3.29	-1.40	0.60
0.5	0.33	11.25	6.46	3.70
1.5	2.48	50.24	79.06	124.40
2.5	6.62	26.96	69.39	178.58
3.5	12.77	14.85	53.08	189.68
4.5	20.92	16.30	74.53	340.87
		336.72	-537.90	4158.57

First Moment:
Mean = Sum(Wt%*Midpt)/100
= -0.073622

Second Moment:
Dispersion= Sum((Wt%)*(Dev*2))/100
= 3.3672480
Square Root of Second Moment:
Standard Deviation= 1.8350062

Third Moment = Sum((Wt%)*(Dev*3))/100
= -5.378960
Skewness = Third Moment/(Standard deviation*3)
= -0.870533

Fourth Moment = Sum((Wt%)*(Dev*4))/100
= 41.585709
Kurtosis = Fourth Moment/(Standard Deviation*4)
= 3.6677006

Method of Moments Grain Size Analysis

RMA 33085

Sample 63.5-64.5

Phi Class Midpoint	Wt (g)	Wt %	Midpt*Wt%	Deviation Mpt-Mean
-5.5	0	0.00	0.00	-4.54
-4.5	0	0.00	0.00	-3.54
-3.5	40.7	6.01	-21.04	-2.54
-2.5	153.8	22.71	-56.79	-1.54
-1.5	215.3	31.80	-47.70	-0.54
-0.5	97.7	14.43	-7.21	0.46
0.5	71.7	10.59	5.29	1.46
1.5	51.7	7.64	11.45	2.46
2.5	31.8	4.70	11.74	3.46
3.5	10	1.48	5.17	4.46
4.5	4.4	0.65	2.92	5.46
	677.1	100	-96.15	

Phi Class Midpoint	Dev*2	Wt%*Dev*2	Wt%*Dev*3	Wt%*Dev*4
-5.5	20.60	0.00	0.00	0.00
-4.5	12.52	0.00	0.00	0.00
-3.5	6.44	38.73	-98.32	249.59
-2.5	2.37	53.76	-82.71	127.25
-1.5	0.29	9.22	-4.96	2.67
-0.5	0.21	3.07	1.42	0.65
0.5	2.14	22.62	33.06	48.32
1.5	6.06	46.26	113.88	280.32
2.5	11.98	56.27	194.79	674.29
3.5	19.91	29.40	131.16	585.17
4.5	29.83	19.38	105.86	578.17
		278.73	394.17	2546.44

First Moment:

Mean = Sum(Wt%*Midpt)/100

= -0.961527

Second Moment:

Dispersion= Sum((Wt%)*(Dev*2))/100

= 2.7872881

Square Root of Second Moment:

Standard Deviation= 1.6695173

Third Moment = Sum((Wt%)*(Dev*3))/100

= 3.9417329

Skewness = Third Moment/(Standard deviation*3)

= 0.8470604

Fourth Moment = Sum((Wt%)*(Dev*4))/100

= 25.464374

Kurtosis = Fourth Moment/(Standard Deviation*4)

= 3.2777006

Method of Moments Grain Size Analysis
RMA 33085
Sample 64.5-65.5

Phi Class Midpoint	Wt (g)	Wt %	Midpt*Wt%	Deviation Mpt-Mean
-5.5	0	0.00	0.00	-4.58
-4.5	0	0.00	0.00	-3.58
-3.5	50.8	7.11	-24.88	-2.58
-2.5	123.4	17.27	-43.18	-1.58
-1.5	196.3	27.47	-41.21	-0.58
-0.5	171.2	23.96	-11.98	0.42
0.5	99.2	13.88	6.94	1.42
1.5	38.8	5.43	8.15	2.42
2.5	22.6	3.16	7.91	3.42
3.5	8	1.12	3.92	4.42
4.5	4.2	0.59	2.65	5.42
	714.5	100	-91.69	

Phi Class Midpoint	Dev*2	Wt%*Dev*2	Wt%*Dev*3	Wt%*Dev*4
-5.5	21.00	0.00	0.00	0.00
-4.5	12.84	0.00	0.00	0.00
-3.5	6.67	47.44	-122.54	316.52
-2.5	2.51	43.28	-68.52	108.47
-1.5	0.34	9.34	-5.45	3.18
-0.5	0.17	4.17	1.74	0.72
0.5	2.01	27.87	39.50	55.96
1.5	5.84	31.72	76.67	185.31
2.5	11.68	36.93	126.19	431.17
3.5	19.51	21.84	96.48	426.16
4.5	29.34	17.25	93.43	506.13
		239.85	237.51	2033.62

First Moment:
Mean = Sum(Wt%*Midpt)/100
= -0.916934

Second Moment:
Dispersion= Sum((Wt%)*(Dev*2))/100
= 2.3984535
Square Root of Second Moment:
Standard Deviation= 1.5486941

Third Moment = Sum((Wt%)*(Dev*3))/100
= 2.3750641
Skewness = Third Moment/(Standard deviation*3)
= 0.6394084

Fourth Moment = Sum((Wt%)*(Dev*4))/100
= 20.336230
Kurtosis = Fourth Moment/(Standard Deviation*4)
= 3.5351498

Method of Moments Grain Size Analysis
RMA 33085
Sample 65.5-66.5

Phi Class Midpoint	Wt (g)	Wt %	Midpt*Wt%	Deviation Mpt-Mean
-5.5	0	0.00	0.00	-4.63
-4.5	7.3	0.95	-4.29	-3.63
-3.5	45.1	5.89	-20.62	-2.63
-2.5	138	18.03	-45.06	-1.63
-1.5	197.3	25.77	-38.66	-0.63
-0.5	161.2	21.06	-10.53	0.37
0.5	125.6	16.41	8.20	1.37
1.5	59.5	7.77	11.66	2.37
2.5	21.1	2.76	6.89	3.37
3.5	6.5	0.85	2.97	4.37
4.5	4	0.52	2.35	5.37
	765.6	100	-87.08	

Phi Class Midpoint	Dev*2	Wt%*Dev*2	Wt%*Dev*3	Wt%*Dev*4
-5.5	21.43	0.00	0.00	0.00
-4.5	13.17	12.56	-45.58	165.41
-3.5	6.91	40.72	-107.06	281.49
-2.5	2.65	47.84	-77.94	126.99
-1.5	0.40	10.20	-6.42	4.04
-0.5	0.14	2.90	1.07	0.40
0.5	1.88	30.83	42.26	57.93
1.5	5.62	43.68	103.56	245.53
2.5	11.36	31.31	105.56	355.81
3.5	19.10	16.22	70.89	309.86
4.5	28.85	15.07	80.94	434.73
		251.34	167.29	1982.18

First Moment:
Mean = Sum(Wt%*Midpt)/100
= -0.870820

Second Moment:
Dispersion= Sum((Wt%)*(Dev*2))/100
= 2.5133543
Square Root of Second Moment:
Standard Deviation= 1.5853562

Third Moment = Sum((Wt%)*(Dev*3))/100
= 1.6728871
Skewness = Third Moment/(Standard deviation*3)
= 0.4198421

Fourth Moment = Sum((Wt%)*(Dev*4))/100
= 19.821814
Kurtosis = Fourth Moment/(Standard Deviation*4)
= 3.1378771

Method of Moments Grain Size Analysis
RMA 33085
Sample 66.5-68.5

Phi Class Midpoint	Wt (g)	Wt %	Midpt*Wt%	Deviation Mpt-Mean
-5.5	0	0.00	0.00	-4.50
-4.5	15.9	1.22	-5.49	-3.50
-3.5	138.8	10.64	-37.25	-2.50
-2.5	252.2	19.34	-48.35	-1.50
-1.5	291.2	22.33	-33.50	-0.50
-0.5	236.3	18.12	-9.06	0.50
0.5	212.4	16.29	8.14	1.50
1.5	94.6	7.25	10.88	2.50
2.5	38.4	2.94	7.36	3.50
3.5	14.5	1.11	3.89	4.50
4.5	9.7	0.74	3.35	5.50
	1304	100	-100.02	

Phi Class Midpoint	Dev*2	Wt%*Dev*2	Wt%*Dev*3	Wt%*Dev*4
-5.5	20.25	0.00	0.00	0.00
-4.5	12.25	14.93	-52.27	182.93
-3.5	6.25	66.51	-166.27	415.63
-2.5	2.25	43.50	-65.24	97.85
-1.5	0.25	5.58	-2.79	1.39
-0.5	0.25	4.53	2.27	1.13
0.5	2.25	36.66	55.00	82.51
1.5	6.25	45.35	113.38	283.49
2.5	12.25	36.08	126.28	442.02
3.5	20.25	22.52	101.34	456.07
4.5	30.25	22.50	123.78	680.80
		298.17	235.48	2643.82

First Moment:
Mean = Sum(Wt%*Midpt)/100
= -1.000230

Second Moment:
Dispersion= Sum((Wt%)*(Dev*2))/100
= 2.9817484
Square Root of Second Moment:
Standard Deviation= 1.7267739

Third Moment = Sum((Wt%)*(Dev*3))/100
= 2.3548378
Skewness = Third Moment/(Standard deviation*3)
= 0.4573561

Fourth Moment = Sum((Wt%)*(Dev*4))/100
= 26.438209
Kurtosis = Fourth Moment/(Standard Deviation*4)
= 2.9736512

Method of Moments Grain Size Analysis

RMA 33085

Sample 68.5-69.5

Phi Class Midpoint	Wt (g)	Wt %	Midpt*Wt%	Deviation Mpt-Mean
-5.5	0	0.00	0.00	-5.65
-4.5	0	0.00	0.00	-4.65
-3.5	0	0.00	0.00	-3.65
-2.5	9	1.31	-3.28	-2.65
-1.5	98.3	14.33	-21.49	-1.65
-0.5	228.6	33.32	-16.66	-0.65
0.5	200.9	29.29	14.64	0.35
1.5	101.5	14.80	22.19	1.35
2.5	35.4	5.16	12.90	2.35
3.5	8.1	1.18	4.13	3.35
4.5	4.2	0.61	2.76	4.35
	686	100	15.19	

Phi Class Midpoint	Dev*2	Wt%*Dev*2	Wt%*Dev*3	Wt%*Dev*4
-5.5	31.94	0.00	0.00	0.00
-4.5	21.64	0.00	0.00	0.00
-3.5	13.34	0.00	0.00	0.00
-2.5	7.03	9.23	-24.47	64.88
-1.5	2.73	39.10	-64.59	106.70
-0.5	0.42	14.16	-9.23	6.02
0.5	0.12	3.55	1.24	0.43
1.5	1.82	26.89	36.25	48.87
2.5	5.51	28.45	66.81	156.87
3.5	11.21	13.24	44.32	148.37
4.5	18.91	11.58	50.33	218.84
		146.19	100.65	750.99

First Moment:

Mean = Sum(Wt%*Midpt)/100

= 0.1518950

Second Moment:

Dispersion= Sum((Wt%)*(Dev*2))/100

= 1.4619133

Square Root of Second Moment:

Standard Deviation= 1.2090960

Third Moment = Sum((Wt%)*(Dev*3))/100

= 1.0064894

Skewness = Third Moment/(Standard deviation*3)

= 0.5694122

Fourth Moment = Sum((Wt%)*(Dev*4))/100

= 7.5098757

Kurtosis = Fourth Moment/(Standard Deviation*4)

= 3.5139008

Method of Moments Grain Size Analysis

RMA 33085
Sample 69.5-70.5

Phi Class Midpoint	Wt (g)	Wt %	Midpt*Wt%	Deviation Mpt-Mean
-5.5	0	0.00	0.00	-4.26
-4.5	40.4	5.56	-25.01	-3.26
-3.5	47.8	6.57	-23.01	-2.26
-2.5	143.1	19.68	-49.21	-1.26
-1.5	181.4	24.95	-37.43	-0.26
-0.5	158.6	21.82	-10.91	0.74
0.5	104.1	14.32	7.16	1.74
1.5	33.9	4.66	6.99	2.74
2.5	9.5	1.31	3.27	3.74
3.5	4.3	0.59	2.07	4.74
4.5	3.9	0.54	2.41	5.74
	727	100	-123.66	

Phi Class Midpoint	Dev*2	Wt%*Dev*2	Wt%*Dev*3	Wt%*Dev*4
-5.5	18.18	0.00	0.00	0.00
-4.5	10.65	59.18	-193.14	630.28
-3.5	5.12	33.68	-76.24	172.56
-2.5	1.60	31.42	-39.70	50.15
-1.5	0.07	1.73	-0.46	0.12
-0.5	0.54	11.84	8.72	6.42
0.5	3.02	43.18	74.99	130.23
1.5	7.49	34.92	95.56	261.52
2.5	13.96	18.24	68.17	254.74
3.5	22.44	13.27	62.85	297.71
4.5	32.91	17.65	101.27	580.96
		265.12	102.05	2384.69

First Moment:
Mean = Sum(Wt%*Midpt)/100
= -1.236588

Second Moment:
Dispersion= Sum((Wt%)*(Dev*2))/100
= 2.6512472

Square Root of Second Moment:
Standard Deviation= 1.6282650

Third Moment = Sum((Wt%)*(Dev*3))/100
= 1.0204554

Skewness = Third Moment/(Standard deviation*3)
= 0.2363843

Fourth Moment = Sum((Wt%)*(Dev*4))/100
= 23.846912

Kurtosis = Fourth Moment/(Standard Deviation*4)
= 3.3925925

Method of Moments Grain Size Analysis
RMA 33085
Sample 70.5-71.5

Phi Class Midpoint	Wt (g)	Wt %	Midpt*Wt%	Deviation Mpt-Mean
-5.5	0	0.00	0.00	-3.91
-4.5	105.2	13.17	-59.27	-2.91
-3.5	84.8	10.62	-37.16	-1.91
-2.5	150.3	18.82	-47.05	-0.91
-1.5	170.2	21.31	-31.96	0.09
-0.5	124.3	15.56	-7.78	1.09
0.5	96	12.02	6.01	2.09
1.5	39	4.88	7.32	3.09
2.5	16	2.00	5.01	4.09
3.5	7.8	0.98	3.42	5.09
4.5	5.1	0.64	2.87	6.09
	798.7	100	-158.59	

Phi Class Midpoint	Dev*2	Wt%*Dev*2	Wt%*Dev*3	Wt%*Dev*4
-5.5	15.32	0.00	0.00	0.00
-4.5	8.49	111.85	-325.95	949.85
-3.5	3.66	38.90	-74.46	142.52
-2.5	0.84	15.72	-14.37	13.14
-1.5	0.01	0.16	0.01	0.00
-0.5	1.18	18.35	19.93	21.64
0.5	4.35	52.30	109.08	227.54
1.5	9.52	46.50	143.49	442.79
2.5	16.69	33.44	136.65	558.32
3.5	25.87	25.26	128.47	653.40
4.5	37.04	23.65	143.93	875.96
		366.13	266.78	3885.16

First Moment:
Mean = Sum(Wt%*Midpt)/100
= -1.585889

Second Moment:
Dispersion= Sum((Wt%)*(Dev*2))/100
= 3.6613346
Square Root of Second Moment:
Standard Deviation= 1.9134614

Third Moment = Sum((Wt%)*(Dev*3))/100
= 2.6678461
Skewness = Third Moment/(Standard deviation*3)
= 0.3808041

Fourth Moment = Sum((Wt%)*(Dev*4))/100
= 38.851605
Kurtosis = Fourth Moment/(Standard Deviation*4)
= 2.8982118

Method of Moments Grain Size Analysis
RMA 33085
Sample 71.5-73

Phi Class Midpoint	Wt (g)	Wt %	Midpt*Wt%	Deviation Mpt-Mean
-5.5	0	0.00	0.00	-5.08
-4.5	131	14.21	-63.92	-4.08
-3.5	65.2	7.07	-24.75	-3.08
-2.5	102.8	11.15	-27.87	-2.08
-1.5	104.2	11.30	-16.95	-1.08
-0.5	102.3	11.09	-5.55	-0.08
0.5	67.8	7.35	3.68	0.92
1.5	139.7	15.15	22.72	1.92
2.5	122.4	13.27	33.18	2.92
3.5	49.5	5.37	18.79	3.92
4.5	37.3	4.04	18.20	4.92
	922.2	100	-42.46	

Phi Class Midpoint	Dev*2	Wt%*Dev*2	Wt%*Dev*3	Wt%*Dev*4
-5.5	25.76	0.00	0.00	0.00
-4.5	16.61	235.93	-961.49	3918.42
-3.5	9.46	66.87	-205.64	632.42
-2.5	4.31	48.01	-99.64	206.80
-1.5	1.16	13.07	-14.05	15.11
-0.5	0.01	0.06	-0.00	0.00
0.5	0.85	6.29	5.81	5.37
1.5	3.70	56.11	108.00	207.86
2.5	8.55	113.53	332.03	971.06
3.5	15.40	82.68	324.47	1273.44
4.5	24.25	98.09	483.07	2378.92
		720.63	-27.46	9609.40

First Moment:
Mean = Sum(Wt%*Midpt)/100
= -0.424636

Second Moment:
Dispersion= Sum((Wt%)*(Dev*2))/100
= 7.2063134
Square Root of Second Moment:
Standard Deviation= 2.6844577

Third Moment = Sum((Wt%)*(Dev*3))/100
= -0.274572
Skewness = Third Moment/(Standard deviation*3)
= -0.014193

Fourth Moment = Sum((Wt%)*(Dev*4))/100
= 96.094049
Kurtosis = Fourth Moment/(Standard Deviation*4)
=1.8504195

Method of Moments Grain Size Analysis
RMA 33085
Sample 73.5-74.5

Phi Class Midpoint	Wt (g)	Wt %	Midpt*Wt%	Deviation Mpt-Mean
-5.5	0	0.00	0.00	-6.86
-4.5	0	0.00	0.00	-5.86
-3.5	0	0.00	0.00	-4.86
-2.5	0	0.00	0.00	-3.86
-1.5	1.77	0.81	-1.21	-2.86
-0.5	17.25	7.86	-3.93	-1.86
0.5	66.99	30.52	15.26	-0.86
1.5	74.53	33.95	50.93	0.14
2.5	43.93	20.01	50.03	1.14
3.5	12.09	5.51	19.28	2.14
4.5	2.96	1.35	6.07	3.14
	219.52	100	136.42	

Phi Class Midpoint	Dev*2	Wt%*Dev*2	Wt%*Dev*3	Wt%*Dev*4
-5.5	47.12	0.00	0.00	0.00
-4.5	34.39	0.00	0.00	0.00
-3.5	23.66	0.00	0.00	0.00
-2.5	14.93	0.00	0.00	0.00
-1.5	8.20	6.61	-18.95	54.26
-0.5	3.48	27.31	-50.91	94.90
0.5	0.75	22.79	-19.70	17.02
1.5	0.02	0.63	0.09	0.01
2.5	1.29	25.82	29.32	33.30
3.5	4.56	25.12	53.66	114.60
4.5	9.83	13.26	41.58	130.38
		121.54	35.09	444.49

First Moment:
Mean = Sum(Wt%*Midpt)/100
= 1.3642037

Second Moment:
Dispersion= Sum((Wt%)*(Dev*2))/100
= 1.2153877
Square Root of Second Moment:
Standard Deviation= 1.1024462

Third Moment = Sum((Wt%)*(Dev*3))/100
= 0.3509103
Skewness = Third Moment/(Standard deviation*3)
= 0.2618930

Fourth Moment = Sum((Wt%)*(Dev*4))/100
= 4.4448702
Kurtosis = Fourth Moment/(Standard Deviation*4)
=3.0090499

Method of Moments Grain Size Analysis
RMA 33085
Sample 74.5-75.5

Phi Class Midpoint	Wt (g)	Wt %	Midpt*Wt%	Deviation Mpt-Mean
-5.5	0	0.00	0.00	-6.19
-4.5	0	0.00	0.00	-5.19
-3.5	2.9	1.27	-4.44	-4.19
-2.5	5.03	2.20	-5.50	-3.19
-1.5	15.13	6.61	-9.92	-2.19
-0.5	38.15	16.67	-8.34	-1.19
0.5	75.21	32.87	16.44	-0.19
1.5	58.18	25.43	38.14	0.81
2.5	25.5	11.14	27.86	1.81
3.5	5.98	2.61	9.15	2.81
4.5	2.73	1.19	5.37	3.81
	228.81	100	68.77	

Phi Class Midpoint	Dev*2	Wt%*Dev*2	Wt%*Dev*3	Wt%*Dev*4
-5.5	38.29	0.00	0.00	0.00
-4.5	26.91	0.00	0.00	0.00
-3.5	17.54	22.23	-93.08	389.77
-2.5	10.16	22.34	-71.21	226.98
-1.5	4.79	31.65	-69.23	151.46
-0.5	1.41	23.52	-27.93	33.17
0.5	0.04	1.16	-0.22	0.04
1.5	0.66	16.78	13.63	11.07
2.5	3.28	36.61	66.34	120.23
3.5	7.91	20.67	58.13	163.49
4.5	14.53	17.34	66.11	252.03
		192.28	-57.45	1348.25

First Moment:
Mean = Sum(Wt%*Midpt)/100
= 0.6876666

Second Moment:
Dispersion= Sum((Wt%)*(Dev*2))/100
= 1.9228250
Square Root of Second Moment:
Standard Deviation= 1.3866596

Third Moment = Sum((Wt%)*(Dev*3))/100
= -0.574496
Skewness = Third Moment/(Standard deviation*3)
= -0.215465

Fourth Moment = Sum((Wt%)*(Dev*4))/100
= 13.482462
Kurtosis = Fourth Moment/(Standard Deviation*4)
=3.6466132

Method of Moments Grain Size Analysis
RMA 33085
Sample 75.5-76.5

Phi Class Midpoint	Wt (g)	Wt %	Midpt*Wt%	Deviation Mpt-Mean
-5.5	0	0.00	0.00	-6.47
-4.5	0	0.00	0.00	-5.47
-3.5	0	0.00	0.00	-4.47
-2.5	1.6	0.84	-2.11	-3.47
-1.5	4.6	2.43	-3.64	-2.47
-0.5	16.6	8.76	-4.38	-1.47
0.5	74.6	39.39	19.69	-0.47
1.5	72.4	38.23	57.34	0.53
2.5	14.4	7.60	19.01	1.53
3.5	3.2	1.69	5.91	2.53
4.5	2	1.06	4.75	3.53
	189.4	100	96.57	

Phi Class Midpoint	Dev*2	Wt%*Dev*2	Wt%*Dev*3	Wt%*Dev*4
-5.5	41.81	0.00	0.00	0.00
-4.5	29.87	0.00	0.00	0.00
-3.5	19.94	0.00	0.00	0.00
-2.5	12.01	10.15	-35.16	121.87
-1.5	6.08	14.77	-36.41	89.77
-0.5	2.15	18.83	-27.60	40.45
0.5	0.22	8.54	-3.98	1.85
1.5	0.29	10.91	5.83	3.12
2.5	2.35	17.90	27.46	42.14
3.5	6.42	10.85	27.50	69.70
4.5	12.49	13.19	46.62	164.77
		105.14	4.27	533.65

First Moment:
Mean = Sum(Wt%*Midpt)/100
= 0.9656810

Second Moment:
Dispersion= Sum((Wt%)*(Dev*2))/100
= 1.0513565
Square Root of Second Moment:
Standard Deviation= 1.0253567

Third Moment = Sum((Wt%)*(Dev*3))/100
= 0.0426827
Skewness = Third Moment/(Standard deviation*3)
= 0.0395937

Fourth Moment = Sum((Wt%)*(Dev*4))/100
= 5.3365354
Kurtosis = Fourth Moment/(Standard Deviation*4)
= 4.8279122

Method of Moments Grain Size Analysis

RMA 33085

Sample 76.5-77.5

Phi Class Midpoint	Wt (g)	Wt %	Midpt*Wt%	Deviation Mpt-Mean
-5.5	0	0.00	0.00	-6.41
-4.5	0	0.00	0.00	-5.41
-3.5	0.89	0.42	-1.47	-4.41
-2.5	3.14	1.48	-3.69	-3.41
-1.5	5.66	2.66	-3.99	-2.41
-0.5	27.01	12.70	-6.35	-1.41
0.5	83.28	39.17	19.59	-0.41
1.5	62.18	29.25	43.87	0.59
2.5	19.95	9.38	23.46	1.59
3.5	5.76	2.71	9.48	2.59
4.5	4.73	2.22	10.01	3.59
	212.6	100	90.91	

Phi Class Midpoint	Dev*2	Wt%*Dev*2	Wt%*Dev*3	Wt%*Dev*4
-5.5	41.08	0.00	0.00	0.00
-4.5	29.26	0.00	0.00	0.00
-3.5	19.44	8.14	-35.88	158.20
-2.5	11.62	17.16	-58.52	199.49
-1.5	5.80	15.45	-37.22	89.67
-0.5	1.99	25.23	-35.54	50.08
0.5	0.17	6.56	-2.68	1.10
1.5	0.35	10.21	6.04	3.57
2.5	2.53	23.75	37.79	60.11
3.5	6.71	18.19	47.12	122.09
4.5	12.89	28.69	103.02	369.93
		153.37	24.12	1054.25

First Moment:
Mean = Sum(Wt%*Midpt)/100
= 0.9090780

Second Moment:
Dispersion= Sum((Wt%)*(Dev*2))/100
= 1.5337369

Square Root of Second Moment:
Standard Deviation= 1.2384413

Third Moment = Sum((Wt%)*(Dev*3))/100
= 0.2411510

Skewness = Third Moment/(Standard deviation*3)
= 0.1269587

Fourth Moment = Sum((Wt%)*(Dev*4))/100
= 10.542452

Kurtosis = Fourth Moment/(Standard Deviation*4)
= 4.4816699

Method of Moments Grain Size Analysis
RMA 33085
Sample 78.5-79.5

Phi Class Midpoint	Wt (g)	Wt %	Midpt*Wt%	Deviation Mpt-Mean
-5.5	0	0.00	0.00	-6.28
-4.5	0	0.00	0.00	-5.28
-3.5	0	0.00	0.00	-4.28
-2.5	0.1	0.05	-0.13	-3.28
-1.5	5.9	3.15	-4.73	-2.28
-0.5	32.8	17.52	-8.76	-1.28
0.5	74.4	39.74	19.87	-0.28
1.5	55.3	29.54	44.31	0.72
2.5	14.9	7.96	19.90	1.72
3.5	2.6	1.39	4.86	2.72
4.5	1.2	0.64	2.88	3.72
	187.2	100	78.21	

Phi Class Midpoint	Dev*2	Wt%*Dev*2	Wt%*Dev*3	Wt%*Dev*4
-5.5	39.46	0.00	0.00	0.00
-4.5	27.90	0.00	0.00	0.00
-3.5	18.34	0.00	0.00	0.00
-2.5	10.77	0.58	-1.89	6.20
-1.5	5.21	16.41	-37.46	85.48
-0.5	1.64	28.80	-36.92	47.34
0.5	0.08	3.16	-0.89	0.25
1.5	0.52	15.23	10.93	7.85
2.5	2.95	23.49	40.36	69.33
3.5	7.39	10.26	27.89	75.79
4.5	13.82	8.86	32.94	122.49
		106.79	34.96	414.72

First Moment:
Mean = Sum(Wt%*Midpt)/100
= 0.7820512

Second Moment:
Dispersion= Sum((Wt%)*(Dev*2))/100
= 1.0678829
Square Root of Second Moment:
Standard Deviation= 1.0333842

Third Moment = Sum((Wt%)*(Dev*3))/100
= 0.3496097
Skewness = Third Moment/(Standard deviation*3)
= 0.3168093

Fourth Moment = Sum((Wt%)*(Dev*4))/100
= 4.1472128
Kurtosis = Fourth Moment/(Standard Deviation*4)
= 3.6367127

Method of Moments Grain Size Analysis
RMA 33085
Sample 79.5-80.5

Phi Class Midpoint	Wt (g)	Wt %	Midpt*Wt%	Deviation Mpt-Mean
-5.5	0	0.00	0.00	-6.37
-4.5	0	0.00	0.00	-5.37
-3.5	0	0.00	0.00	-4.37
-2.5	1.14	0.26	-0.66	-3.37
-1.5	10.1	2.32	-3.48	-2.37
-0.5	73.42	16.88	-8.44	-1.37
0.5	178.4	41.01	20.50	-0.37
1.5	117.1	26.92	40.37	0.63
2.5	33.4	7.68	19.19	1.63
3.5	11	2.53	8.85	2.63
4.5	10.5	2.41	10.86	3.63
	435.06	100	87.20	

Phi Class Midpoint	Dev*2	Wt%*Dev*2	Wt%*Dev*3	Wt%*Dev*4
-5.5	40.60	0.00	0.00	0.00
-4.5	28.86	0.00	0.00	0.00
-3.5	19.11	0.00	0.00	0.00
-2.5	11.37	2.98	-10.05	33.88
-1.5	5.63	13.06	-30.98	73.50
-0.5	1.88	31.77	-43.59	59.80
0.5	0.14	5.68	-2.11	0.79
1.5	0.39	10.61	6.67	4.19
2.5	2.65	20.35	33.12	53.92
3.5	6.91	17.46	45.89	120.59
4.5	13.16	31.77	115.25	418.11
		133.67	114.19	764.77

First Moment:
Mean = Sum(Wt%*Midpt)/100
= 0.8720406

Second Moment:
Dispersion= Sum((Wt%)*(Dev*2))/100
= 1.3367386
Square Root of Second Moment:
Standard Deviation= 1.1561741

Third Moment = Sum((Wt%)*(Dev*3))/100
= 1.1419177
Skewness = Third Moment/(Standard deviation*3)
= 0.7388649

Fourth Moment = Sum((Wt%)*(Dev*4))/100
= 7.6477344
Kurtosis = Fourth Moment/(Standard Deviation*4)
= 4.2799609

Method of Moments Grain Size Analysis
RMA 33085
Sample 80.5-81.5

Phi Class Midpoint	Wt (g)	Wt %	Midpt*Wt%	Deviation Mpt-Mean
-5.5	44.4	16.91	-92.98	-4.78
-4.5	0	0.00	0.00	-3.78
-3.5	4.71	1.79	-6.28	-2.78
-2.5	8.7	3.31	-8.28	-1.78
-1.5	23.77	9.05	-13.58	-0.78
-0.5	50.16	19.10	-9.55	0.22
0.5	74.1	28.21	14.11	1.22
1.5	37.09	14.12	21.18	2.22
2.5	11.46	4.36	10.91	3.22
3.5	4.44	1.69	5.92	4.22
4.5	3.8	1.45	6.51	5.22
	262.63	100	-72.04	

Phi Class Midpoint	Dev*2	Wt%*Dev*2	Wt%*Dev*3	Wt%*Dev*4
-5.5	22.84	386.21	-1845.94	8822.87
-4.5	14.29	0.00	0.00	0.00
-3.5	7.73	13.86	-38.52	107.06
-2.5	3.17	10.49	-18.67	33.23
-1.5	0.61	5.50	-4.29	3.34
-0.5	0.05	0.93	0.20	0.05
0.5	1.49	42.02	51.28	62.58
1.5	4.93	69.63	154.60	343.26
2.5	10.37	45.25	145.74	469.32
3.5	17.81	30.11	127.09	536.35
4.5	27.25	39.43	205.85	1074.61
		643.43	-1222.66	11452.67

First Moment:
Mean = Sum(Wt%*Midpt)/100
= -0.720386

Second Moment:
Dispersion= Sum((Wt%)*(Dev*2))/100
= 6.4343146
Square Root of Second Moment:
Standard Deviation= 2.5365950

Third Moment = Sum((Wt%)*(Dev*3))/100
= -12.22660
Skewness = Third Moment/(Standard deviation*3)
= -0.749122

Fourth Moment = Sum((Wt%)*(Dev*4))/100
= 114.52667
Kurtosis = Fourth Moment/(Standard Deviation*4)
= 2.7663178

Method of Moments Grain Size Analysis

RMA 33085

Sample 81.5-82.5

Phi Class Midpoint	Wt (g)	Wt %	Midpt*Wt%	Deviation Mpt-Mean
-5.5	0	0.00	0.00	-5.75
-4.5	0	0.00	0.00	-4.75
-3.5	7.65	3.26	-11.41	-3.75
-2.5	12.33	5.25	-13.14	-2.75
-1.5	18.22	7.76	-11.65	-1.75
-0.5	47.26	20.14	-10.07	-0.75
0.5	88.2	37.58	18.79	0.25
1.5	41.02	17.48	26.22	1.25
2.5	12.1	5.16	12.89	2.25
3.5	4.63	1.97	6.91	3.25
4.5	3.26	1.39	6.25	4.25
	234.67	100	24.80	

Phi Class Midpoint	Dev*2	Wt%*Dev*2	Wt%*Dev*3	Wt%*Dev*4
-5.5	33.04	0.00	0.00	0.00
-4.5	22.54	0.00	0.00	0.00
-3.5	14.05	45.79	-171.63	643.27
-2.5	7.55	39.68	-109.03	299.62
-1.5	3.06	23.72	-41.47	72.48
-0.5	0.56	11.27	-8.43	6.30
0.5	0.06	2.39	0.60	0.15
1.5	1.57	27.40	34.31	42.95
2.5	5.07	26.15	58.89	132.62
3.5	10.58	20.87	67.85	220.66
4.5	18.08	25.12	106.79	454.09
		222.38	-62.11	1872.15

First Moment:

Mean = Sum(Wt%*Midpt)/100

= 0.2479865

Second Moment:

Dispersion= Sum((Wt%)*(Dev*2))/100

= 2.2237862

Square Root of Second Moment:

Standard Deviation= 1.4912364

Third Moment = Sum((Wt%)*(Dev*3))/100

= -0.621126

Skewness = Third Moment/(Standard deviation*3)

= -0.187301

Fourth Moment = Sum((Wt%)*(Dev*4))/100

= 18.721518

Kurtosis = Fourth Moment/(Standard Deviation*4)

= 3.7857766

Method of Moments Grain Size Analysis
RMA 33085
Sample 84.75-85.00

Phi Class Midpoint	Wt (g)	Wt %	Midpt*Wt%	Deviation Mpt-Mean
-5.5	0	0.00	0.00	-6.68
-4.5	0	0.00	0.00	-5.68
-3.5	0	0.00	0.00	-4.68
-2.5	1.96	1.41	-3.52	-3.68
-1.5	8.16	5.87	-8.80	-2.68
-0.5	20.45	14.70	-7.35	-1.68
0.5	26.5	19.05	9.53	-0.68
1.5	41.23	29.64	44.46	0.32
2.5	30.6	22.00	55.00	1.32
3.5	6.1	4.39	15.35	2.32
4.5	4.1	2.95	13.26	3.32
	139.1	100	117.92	

Phi Class Midpoint	Dev*2	Wt%*Dev*2	Wt%*Dev*3	Wt%*Dev*4
-5.5	44.61	0.00	0.00	0.00
-4.5	32.25	0.00	0.00	0.00
-3.5	21.90	0.00	0.00	0.00
-2.5	13.54	19.07	-70.18	258.20
-1.5	7.18	42.11	-112.82	302.27
-0.5	2.82	41.46	-69.61	116.90
0.5	0.46	8.79	-5.97	4.05
1.5	0.10	3.05	0.98	0.31
2.5	1.74	38.38	50.69	66.94
3.5	5.39	23.62	54.82	127.21
4.5	11.03	32.50	107.94	358.44
		208.98	-44.16	1234.33

First Moment:
Mean = Sum(Wt%*Midpt)/100
= 1.1792235

Second Moment:
Dispersion= Sum((Wt%)*(Dev*2))/100
= 2.0897696
Square Root of Second Moment:
Standard Deviation= 1.4456035

Third Moment = Sum((Wt%)*(Dev*3))/100
= -0.441640
Skewness = Third Moment/(Standard deviation*3)
= -0.146191

Fourth Moment = Sum((Wt%)*(Dev*4))/100
= 12.343332
Kurtosis = Fourth Moment/(Standard Deviation*4)
=2.8264127

APPENDIX B. LABORATORY HYDRAULIC CONDUCTIVITY ESTIMATES

Core #	Depth interval (ft)[1]	Hydraulic Conductivity Estimates ($x10^{-2}$ cm/sec) HAZEN	MASCH & DENNY	SUMMERS & WEBER	PERMEAMETER
1	59.50-61.00	8.41	0.99	3.5	3.45
1	61.00-62.00	19.36	1.89	8.8	
1	62.00-63.50	10.89	0.99	8.8	0.90
1	69.25-70.25	7.29	0.80	5.3	3.75
1	70.25-71.25	14.44	2.13	5.3	
1	71.25-72.00	2.56	1.89	3.2	0.77
1	74.00-75.00	3.61	0.85	3.5	2.27
1	75.00-76.00	9.00	1.70	3.2	
1	76.00-77.00	7.29	1.89	1.8	2.10
1	77.00-78.00	6.76	3.22	1.4	
1	78.00-79.00	6.76	3.50	0.7	2.61
1	79.00-80.00	1.96	2.41	0.7	
1	80.00-81.00	7.84	1.89	1.8	2.48
1	81.00-81.75	10.89	1.23	7.9	1.55
1	81.75-82.75	16.00	1.70	1.4	1.19
1	82.75-83.75	7.84	0.85	5.3	
1	84.00-85.25	3.61	2.32	1.4	2.18
1	85.25-86.25	5.29	0.85	3.5	1.58
1	86.25-87.25	0.49	0.40	1.4	
1	87.25-88.50	0.64	0.38	3.5	0.01
2	56.50-57.50	3.61	0.95	3.2	
2	57.50-58.50	9.00	1.07	4.4	
2	58.50-59.50	14.44	0.95	5.3	
2	59.50-60.50	20.25	0.71	10.6	
2	60.50-61.50	10.89	0.71	8.8	
2	64.00-65.00	6.25	1.42	3.2	
2	65.00-66.00	25.00	0.76	10.6	
2	66.00-67.00	43.56	1.42	17.6	
2	67.00-68.00	29.16	2.60	14.1	
3	59.80-61.05	10.89	0.99	3.5	
3	61.05-62.30	9.00	0.57	3.5	
3	64.80-65.80	12.96	0.90	14.1	
3	65.80-66.80	24.01	1.18	10.6	
3	66.80-67.80	19.36	1.18	10.6	
3	67.80-69.80	18.49	0.80	12.3	
3	69.80-70.80	9.00	2.56	2.8	
3	70.80-71.80	36.00	1.18	12.3	
3	71.80-72.80	31.36	0.43	16.9	
3	72.80-74.30	1.69	0.14	7.1	
3	74.80-75.80	2.10	2.36	0.9	
3	75.80-76.80	3.80	0.94	1.8	
3	76.80-77.80	6.00	3.77	0.9	
3	77.80-78.80	3.60	3.30	0.9	
3	79.80-80.80	6.25	4.72	0.9	
3	80.80-81.80	4.40	3.30	0.9	
3	81.80-82.80	8.70	0.38	7.1	
3	82.80-83.80	7.29	1.18	2.7	
3	86.05-86.30	2.10	0.99	1.8	

(1) All depths relative to a ground elevation of 5176.4 ft

Hazen's Method for Estimating Hydraulic Conductivity

Core #1 = Injection well 33080

Interval Top	Bottom	D10 (cm)	K (E-2 cm/s)	K/Kmax
59.50	61.00	0.029	8.41	0.19
61.00	62.00	0.044	19.36	0.44
62.00	63.50	0.033	10.89	0.25
69.25	70.25	0.027	7.29	0.17
70.25	71.25	0.038	14.44	0.33
71.25	72.00	0.016	2.56	0.06
74.00	75.00	0.019	3.61	0.08
75.00	76.00	0.030	9.00	0.21
76.00	77.00	0.027	7.29	0.17
77.00	78.00	0.026	6.76	0.16
78.00	79.00	0.026	6.76	0.16
79.00	80.00	0.014	1.96	0.04
80.00	81.00	0.028	7.84	0.18
81.00	81.75	0.033	10.89	0.25
81.75	82.75	0.040	16.00	0.37
82.75	83.75	0.028	7.84	0.18
84.00	85.25	0.019	3.61	0.08
85.25	86.25	0.023	5.29	0.12
86.25	87.25	0.007	0.49	0.01
87.25	88.50	0.008	0.64	0.01

Core #2 = 2 feet adjacent to injection well 33080

Interval Top	Bottom	D10 (cm)	K (E-2 cm/s)	K/Kmax
56.50	57.50	0.019	3.61	0.08
57.50	58.50	0.030	9.00	0.21
58.50	59.50	0.038	14.44	0.33
59.50	60.50	0.045	20.25	0.46
60.50	61.50	0.033	10.89	0.25
64.00	65.00	0.025	6.25	0.14
65.00	66.00	0.050	25.00	0.57
66.00	67.00	0.066	43.56	1.00
67.00	68.00	0.054	29.16	0.67

Hazen's Method for Estimating Hydraulic Conductivity

Core #3 = Extraction well 33085

Interval Top	Bottom	D10 (cm)	K (E-2 cm/s)	K/Kmax
58.50	59.75	0.033	10.89	0.25
59.75	61.00	0.030	9.00	0.21
63.50	64.50	0.036	12.96	0.30
64.50	65.50	0.049	24.01	0.55
65.50	66.50	0.044	19.36	0.44
66.50	68.50	0.043	18.49	0.42
68.50	69.50	0.030	9.00	0.21
69.50	70.50	0.060	36.00	0.83
70.50	71.50	0.056	31.36	0.72
71.50	73.00	0.013	1.69	0.04
73.50	74.50	0.015	2.10	0.05
74.50	75.50	0.020	3.80	0.09
75.50	76.50	0.025	6.00	0.14
76.50	77.50	0.019	3.60	0.08
78.50	79.50	0.025	6.25	0.14
79.50	80.50	0.021	4.40	0.10
80.50	81.50	0.030	8.70	0.20
81.50	82.50	0.027	7.29	0.17
84.75	85.00	0.014	2.10	0.04

Masch and Denny Technique for Estimating Hydraulic Conductivity

Grain Size Parameters:
Core #1 = Injection well 33080

Interval Top	Bottom	D50	DISP	D5	D16	D84	D95
59.50	61.00	-0.4	1.50	-2.9	-1.9	1.0	2.2
61.00	62.00	-1.2	1.42	-3.2	-2.7	0.2	1.4
62.00	63.50	-1.2	1.60	-3.3	-2.9	0.3	2.0
69.25	70.25	-0.4	1.64	-3.2	-2.5	0.9	2.0
70.25	71.25	-0.8	1.34	-3.0	-2.2	0.5	1.4
71.25	72.00	-0.7	1.38	-2.5	-1.5	0.7	3.0
74.00	75.00	-0.2	1.61	-2.8	-1.9	1.4	2.4
75.00	76.00	-0.1	1.31	-3.0	-1.5	1.0	1.5
76.00	77.00	0	1.24	-2.4	-1.2	1.1	2.0
77.00	78.00	0.2	1.07	-1.5	-0.7	1.2	2.4
78.00	79.00	0.1	1.08	-1.4	-0.8	1.2	2.4
79.00	80.00	0.6	1.07	-0.5	-0.2	2.0	2.9
80.00	81.00	0	1.23	-2.4	-1.3	1.0	2.0
81.00	81.75	-0.9	1.53	-3.2	-2.6	0.5	1.8
81.75	82.75	0.3	1.25	-2.1	-0.8	1.4	2.5
82.75	83.75	-0.7	1.67	-3.2	-2.5	0.8	2.4
84.00	85.25	0.4	1.13	-1.6	-0.7	1.4	2.4
85.25	86.25	-0.1	1.63	-3.1	-2.1	1.2	2.2
86.25	87.25	0.5	2.08	-2.5	-1.8	2.6	4.0
87.25	88.50	-0.5	2.17	-2.9	-2.2	2.4	3.8

Hydraulic Conductivity Estimates:
Core #1 = Injection well 33080

Interval Top	Bottom	K gal/d*ft2	K 10-2cm/s	K/Kmax
59.50	61.00	210	0.99	0.21
61.00	62.00	400	1.89	0.40
62.00	63.50	210	0.99	0.21
69.25	70.25	170	0.80	0.17
70.25	71.25	450	2.13	0.45
71.25	72.00	400	1.89	0.40
74.00	75.00	180	0.85	0.18
75.00	76.00	360	1.70	0.36
76.00	77.00	400	1.89	0.40
77.00	78.00	680	3.22	0.68
78.00	79.00	740	3.50	0.74
79.00	80.00	510	2.41	0.51
80.00	81.00	400	1.89	0.40
81.00	81.75	260	1.23	0.26
81.75	82.75	360	1.70	0.36
82.75	83.75	180	0.85	0.18
84.00	85.25	490	2.32	0.49
85.25	86.25	180	0.85	0.18
86.25	87.25	85	0.40	0.09
87.25	88.50	80	0.38	0.08

Masch and Denny Technique for Estimating Hydraulic Conductivity

Grain Size Parameters:
Core #2 = 2 feet from injection well 33080

Interval Top	Bottom	D50	DISP	D5	D16	D84	D95
56.50	57.50	0.0	1.57	-3.0	-1.5	1.4	2.6
57.50	58.50	-0.4	1.54	-3.4	-2.2	0.8	1.8
58.50	59.50	-0.8	1.59	-4.0	-2.6	0.5	1.4
59.50	60.50	-1.5	1.80	-4.8	-3.3	0.2	1.3
60.50	61.50	-1.0	1.73	-4.1	-2.9	0.5	1.7
64.00	65.00	-0.3	1.40	-2.4	-1.6	1.1	2.4
65.00	66.00	-1.5	1.75	-4.5	-3.3	0.2	1.3
66.00	67.00	-2.4	1.60	-4.4	-3.8	-0.6	0.9
67.00	68.00	-1.8	1.41	-3.3	-3.0	-0.1	1.2

Hydraulic Conductivity Estimates:
Core #2 = 2 feet from injection well 33080

Interval Top	Bottom	K gal/d*ft2	K 10-2cm/s	K/Kmax
56.50	57.50	200	0.95	0.20
57.50	58.50	225	1.07	0.23
58.50	59.50	200	0.95	0.20
59.50	60.50	150	0.71	0.15
60.50	61.50	150	0.71	0.15
64.00	65.00	300	1.42	0.30
65.00	66.00	160	0.76	0.16
66.00	67.00	300	1.42	0.30
67.00	68.00	550	2.60	0.55

Masch and Denny Technique for Estimating Hydraulic Conductivity

Grain Size Parameters:
Core #3 = Extraction well 33085

Interval Top	Bottom	D50	DISP	D5	D16	D84	D95
58.50	59.75	-0.3	1.51	-3.7	-2.1	0.8	1.5
59.75	61.00	-0.2	1.83	-5.0	-2.2	1.0	1.8
63.50	64.50	-1.8	1.68	-3.6	-3.0	0.4	1.9
64.50	65.50	-1.6	1.58	-3.8	-3.0	0.1	1.5
65.50	66.50	-1.5	1.59	-3.8	-3.0	0.2	1.4
66.50	68.50	-1.6	1.75	-4.1	-3.3	0.3	1.5
68.50	69.50	-0.5	1.24	-2.2	-1.5	0.9	2.0
69.50	70.50	-1.8	1.63	-4.5	-3.3	-0.1	1.0
70.50	71.50	-2.2	2.06	-5.6	-4.2	-0.1	1.2
71.50	73.00	-0.9	2.91	-5.6	-4.2	2.0	3.4
73.50	74.50	0.3	1.15	-1.5	-0.8	1.5	2.4
74.50	75.50	-0.3	1.52	-2.8	-1.8	1.0	2.8
75.50	76.50	0.0	0.97	-1.8	-1.0	0.8	1.8
76.50	77.50	-0.3	1.11	-1.8	-1.3	1.0	1.8
78.50	79.50	-0.3	1.02	-1.8	-1.3	0.8	1.7
79.50	80.50	-0.3	1.10	-1.8	-1.3	0.8	2.0
80.50	81.50	-1.0	3.03	-8.0	-6.0	0.3	1.7
81.50	82.50	-0.7	1.46	-3.8	-2.0	0.5	1.8
84.75	85.00	0.3	1.49	-2.4	-1.4	1.6	2.5

Hydraulic Conductivity Estimates:
Core #3 = Extraction well 33085

Interval Top	Bottom	K gal/d*ft2	K 10-2cm/s	K/Kmax
58.50	59.75	210	0.99	0.21
59.75	61.00	120	0.57	0.12
63.50	64.50	190	0.90	0.19
64.50	65.50	250	1.18	0.25
65.50	66.50	250	1.18	0.25
66.50	68.50	170	0.80	0.17
68.50	69.50	540	2.56	0.54
69.50	70.50	250	1.18	0.25
70.50	71.50	90	0.43	0.09
71.50	73.00	30	0.14	0.03
73.50	74.50	500	2.36	0.50
74.50	75.50	200	0.94	0.20
75.50	76.50	800	3.77	0.80
76.50	77.50	700	3.30	0.70
78.50	79.50	1000	4.72	1.00
79.50	80.50	700	3.30	0.70
80.50	81.50	80	0.38	0.08
81.50	82.50	250	1.18	0.25
84.75	85.00	210	0.99	0.21

Summer and Weber's Method for Estimating Hydraulic Conductivity

Grain Size Parameters:
Core #1 = Injection Well 33080

Interval Top	Bottom	% Fine	% Sand	% Gravel
59.50	61.00	1.2	77.6	21.2
61.00	62.00	0.9	56.6	42.5
62.00	63.50	1.1	53.5	45.4
69.25	70.25	0.7	74.1	25.2
70.25	71.25	0.3	68.3	31.4
71.25	72.00	2.2	81.7	16.1
74.00	75.00	1.0	77.4	21.6
75.00	76.00	0.7	83.3	16.0
76.00	77.00	0.8	88.8	10.4
77.00	78.00	1.8	93.3	4.9
78.00	79.00	1.5	95.2	3.3
79.00	80.00	1.9	97.4	0.7
80.00	81.00	0.8	88.3	10.9
81.00	81.75	1.0	61.7	37.3
81.75	82.75	1.4	91.2	7.4
82.75	83.75	1.9	69.0	29.1
84.00	85.25	1.2	93.3	5.5
85.25	86.25	1.2	77.5	21.3
86.25	87.25	8.7	71.7	19.6
87.25	88.50	6.8	64.7	28.5

Hydraulic Conductivity Estimates:
Core #1 = Injection Well 33080

Interval Top	Bottom	K ft/d	K 10-2cm/s	K/Kmax
59.50	61.00	100	3.5	0.20
61.00	62.00	250	8.8	0.50
62.00	63.50	250	8.8	0.50
69.25	70.25	150	5.3	0.30
70.25	71.25	150	5.3	0.30
71.25	72.00	90	3.2	0.18
74.00	75.00	100	3.5	0.20
75.00	76.00	90	3.2	0.18
76.00	77.00	50	1.8	0.10
77.00	78.00	40	1.4	0.08
78.00	79.00	20	0.7	0.04
79.00	80.00	20	0.7	0.04
80.00	81.00	50	1.8	0.10
81.00	81.75	225	7.9	0.45
81.75	82.75	40	1.4	0.08
82.75	83.75	150	5.3	0.30
84.00	85.25	40	1.4	0.08
85.25	86.25	100	3.5	0.20
86.25	87.25	40	1.4	0.08
87.25	88.50	100	3.5	0.20

Summer and Weber's Method for Estimating Hydraulic Conductivity

Grain Size Parameters:
Core #2 = 2 feet adjacent to injection well 33080

Interval Top	Bottom	% Fine	% Sand	% Gravel
56.50	57.50	2.0	82.8	15.2
57.50	58.50	1.1	74.9	24.0
58.50	59.50	0.9	67.3	31.8
59.50	60.50	0.7	49.0	50.3
60.50	61.50	0.9	59.9	39.2
64.00	65.00	1.3	82.0	16.7
65.00	66.00	0.6	48.4	51.0
66.00	67.00	0.5	27.6	71.9
67.00	68.00	0.5	40.7	58.8

Hydraulic Conductivity Estimates:
Core #2 = 2 feet adjacent to injection well 33080

Interval Top	Bottom	K ft/d	K 10-2cm/s	K/Kmax
56.50	57.50	90	3.2	0.18
57.50	58.50	125	4.4	0.25
58.50	59.50	150	5.3	0.30
59.50	60.50	300	10.6	0.60
60.50	61.50	250	8.8	0.50
64.00	65.00	90	3.2	0.18
65.00	66.00	300	10.6	0.60
66.00	67.00	500	17.6	1.00
67.00	68.00	400	14.1	0.80

Summer and Weber's Method for Estimating Hydraulic Conductivity

Grain Size Parameters:
Core #3 = Extraction Well 33085

Interval Top	Bottom	% Fine	% Sand	% Gravel
58.50	59.75	0.4	76.9	22.7
59.75	61.00	0.8	77.9	21.3
63.50	64.50	0.6	38.9	60.5
64.50	65.50	0.6	47.5	51.9
65.50	66.50	0.5	48.8	50.7
66.50	68.50	0.7	45.9	53.4
68.50	69.50	0.6	83.8	15.6
69.50	70.50	0.5	42.6	56.9
70.50	71.50	0.6	35.5	63.9
71.50	73.00	4.0	52.3	43.7
73.50	74.50	1.4	97.8	0.8
74.50	75.50	1.2	88.7	10.1
75.50	76.50	1.1	95.7	3.3
76.50	77.50	2.2	93.2	4.6
78.50	79.50	0.6	96.2	3.2
79.50	80.50	2.4	95.0	2.6
80.50	81.50	1.5	67.5	31.1
81.50	82.50	1.4	82.3	16.3
84.75	85.00	3.0	87.0	10.0

Hydraulic Conductivity Estimates:
Core #3 = Extraction Well 33085

Interval Top	Bottom	K ft/d	K 10-2cm/s	K/Kmax
58.50	59.75	100	3.5	0.20
59.75	61.00	100	3.5	0.20
63.50	64.50	400	14.1	0.80
64.50	65.50	300	10.6	0.60
65.50	66.50	300	10.6	0.60
66.50	68.50	350	12.3	0.70
68.50	69.50	80	2.8	0.16
69.50	70.50	350	12.3	0.70
70.50	71.50	450	16.9	0.96
71.50	73.00	200	7.1	0.40
73.50	74.50	25	0.9	0.05
74.50	75.50	50	1.8	0.10
75.50	76.50	25	0.9	0.05
76.50	77.50	25	0.9	0.05
78.50	79.50	25	0.9	0.05
79.50	80.50	25	0.9	0.05
80.50	81.50	200	7.1	0.40
81.50	82.50	75	2.7	0.15
84.75	85.00	50	1.8	0.10

APPENDIX C. LOCATION AND CONSTRUCTION OF WELLS

Well #	Well Type	Ground Elevation	Distance from 33080	Screened Depth	Bentonite Seal Depth	Depth to water
33080	Injection	5176.4	0	52.5-87.5	43.5-48.5	56.8
33082	Drive Pt B	5176.0	9.13	69.0-69.5	-----	56.2
33083	Drive Pt C	5176.0	9.13	78.0-78.5	-----	56.2
33084	Drive Pt D	5176.0	9.13	84.0-84.5	-----	56.2
33085	Extraction	5175.1	27.61	54.5-86.0	47.0-52.0	55.2
33086	Monitoring	5175.7	17.09	56.0-86.0	49.0-54.0	55.8
33087	Drive Pt A	5176.1	11.75	65.5-66.0	49.0-54.0	56.1

EBASCO SERVICES INCORPORATED
ENVIRONMENTAL PROGRAM AT ROCKY MOUNTAIN ARSENAL

FIELD LOG OF BORING

SHEET 1 OF 8

PROJECT NAME	TASK NUMBER	SITE TYPE	SITE ID
Rocky Mountain Arsenal	48	BORE	33080

DRILLING COMPANY	DRILLER	DATE AND TIME STARTED	DATE AND TIME COMPLETED
Custom Auger	F. PARKS	87286 0829	87294 1604

DRILLING EQUIPMENT · METHOD	COMPLETION DEPTH	WATER LEVEL	NO. OF SAMPLES
CME hollow stem auger / PISTON DRIVE ~~SAMPLER~~ (5")	87.5 ft / 2669 cm	57.5 ft / 1753 cm	5

SIZE AND TYPE OF BIT	HYDROGEOLOGIST / DATE	CHECKED BY / DATE
8 inch	[illegible] / 87294	

DEPTH ft	DEPTH cm	SAMPLE INTERVAL	DESCRIPTION INTERVAL	RECOVERY (cm/cm)	DESCRIPTION (COLOR, TEXTURE, STRUCTURE)	ESTIMATED PERCENTAGE OF: VERY COARSE / GRAVEL	SAND: COARSE	SAND: MEDIUM	SAND: FINE	SILT / CLAY	SOIL CLASSIFICATION USCS	MOISTURE	CONSISTENCY / DENSITY	COLOR	COMMENTS (SAMPLE NUMBER)
0	0				0-91 Yellowish brown silty fine sand, roots	—	—	—	60	+/-	ML	DRY	VL	10YR 5/4	Logged cuttings from 0 -
1	30														
2	61														
3	91				91-152 - Yellowish brn fine sand, minor silt	—	—	—	90	10/-	ML	LM	VL	10YR 5/6	
4	122				152-183 Yellowish brn Clayey, fine sand, trace of esc grains, biotite	—	1	—	95	5/-	ML	LM	L	10YR 5/6	
5	152				clay in balls										
6	183				183-305 - Same										
7	213														
8	244														
9	274				274-305										
10	305				$CaCO_3$ in small nodules										

EBASCO SERVICES INCORPORATED
ENVIRONMENTAL PROGRAM AT ROCKY MOUNTAIN ARSENAL

FIELD LOG OF BORING

SITE TYPE: BORE | SITE ID: 33080 | SHEET 2 OF 8

DEPTH ft	DEPTH cm	SAMPLE INTERVAL	DESCRIPTION INTERVAL	RECOVERY (cm/cm)	DESCRIPTION (COLOR, TEXTURE, STRUCTURE)	ESTIMATED PERCENTAGE OF: VERY COARSE / GRAVEL	SAND: COARSE	SAND: MEDIUM	SAND: FINE	SILT / CLAY	SOIL CLASSIFICATION USCS	MOISTURE	CONSISTENCY / DENSITY	COLOR	COMMENTS (SAMPLE NUMBER)
10	305														
					305 - 350 Yellowish brown med - crse sandy granular gravel, small pebbles, poorly sorted	40	30	30	-	7	GP	Lm	VL	10YR 5/6	
11	335														
	350														
12	366				350 - 427 Brownish yellow v. crs to med sand & minor granules and small pebbles moderately sorted, subrounded	10	30	60	-	7	GP	Lm	VL	10YR 6/4	
13	396														
	427														
15	457				427 - 518 Yellowish brn coarse sand, minor to trace granules, well sorted, subrounded grains	5	95	-	-	7	GW	Lm	VL	10YR 5/4	
16	488														
17	518														
					518 - 579 Brownish yellow coarse sand, minor granules trace fines, well to mod well sorted, subrounded grains	5	93	-	2	7	GW	Lm	VL	10YR 5/6	
18	549														
19	579				579-599 - Same										
R75	594				599 - 610 Brownish yellow med. to coarse sandy gravel w/ minor cobble poorly sorted	10	55	35	-	7	GP	Lm	VL	10YR 6/4	
20	610														
1	640				610 - 732 Lt yellowish brn fine to med. sand, trace granules, minor coarse	3	7	60	30	7	SP	Lm	VL	10YR 6/4	
22	670														
23	701														

EBASCO SERVICES INCORPORATED
ENVIRONMENTAL PROGRAM AT ROCKY MOUNTAIN ARSENAL

FIELD LOG OF BORING

SITE TYPE: BORE | SITE ID: 33080 | SHEET 3 OF 8

DEPTH ft	DEPTH cm	SAMPLE INTERVAL	DESCRIPTION INTERVAL	RECOVERY (cm/cm)	DESCRIPTION (COLOR, TEXTURE, STRUCTURE)	ESTIMATED PERCENTAGE OF: VERY COARSE / GRAVEL	SAND: COARSE	SAND: MEDIUM	SAND: FINE	SILT / CLAY	SOIL CLASSIFICATION USCS	MOISTURE	CONSISTENCY / DENSITY	COLOR	COMMENTS (SAMPLE NUMBER)
23	701														
24	732				732 - 884 Same.										
25	762														
26	792														
	823				823 Driller notes augers are binding, possibly clayey										
28	853														
29	884				884-1034 Yellowish brown med, coarse & very coarse sandy gravel minor granules, in frequent pebbles (conglomeratic - poorly cemented, coarse sand + pebbles) ≤ 1" diam or less, poorly sorted ≤6 pebbles well cemented sc	10/5	20	65	—	5/—	GP	LM	VL	10YR5/4	
30	914														
31	945														
32	975														
33	1006				1036 - 1067 (estimated) large pebbles in cuttings (volcanic and metamorphic in origin (chert-permified wd)										
	1036														
35	1067				1067 - 1189 Clayey f. sand and silt, in balls in cuttings Yellowish brown	—	—	—	70	20/10	CL-ML	LM	SO	10YR5/6	

EBASCO SERVICES INCORPORATED
ENVIRONMENTAL PROGRAM AT ROCKY MOUNTAIN ARSENAL

FIELD LOG OF BORING

SITE TYPE: BORE | SITE ID: 33080 | SHEET 4 OF 8

DEPTH ft	DEPTH cm	SAMPLE INTERVAL	DESCRIPTION INTERVAL	RECOVERY (cm/cm)	DESCRIPTION (COLOR, TEXTURE, STRUCTURE)	ESTIMATED PERCENTAGE OF: VERY COARSE / GRAVEL	SAND: COARSE	SAND: MEDIUM	SAND: FINE	SILT / CLAY	SOIL CLASSIFICATION USCS	MOISTURE	CONSISTENCY / DENSITY	COLOR	COMMENTS (SAMPLE NUMBER)
36	1097				along with pea gravel Note: driller felt auger binding ~35' but did not hit any gravel or large pebbles.										
37	1128														
38	1158														
39	1189				1189-1341 Yellowish brown clayey silt. Dry to 43' (1250)	-	-	-	-	60/40	CL-ML	dry	SO	10YR 5/4	
	1219														
41	1250														
42	1280				42 (1280-1341) Driller notes clay more moist and easier to penetrate.										
43	1311														
44	1341				1341-1448 Clayey silt soft (driller note)	-	-	-	-	60/40	CL-ML	dry	SO	10YR 5/4	
45	1372														
46	1402														
	1433														
47	1448				1448-1494 Clayey silt hard again (Driller note)	-	-	-	-	60/40	CL-ML	dry	SO	10YR 5/4	
48	1463														
49	1494														

EBASCO SERVICES INCORPORATED
ENVIRONMENTAL PROGRAM AT ROCKY MOUNTAIN ARSENAL

FIELD LOG OF BORING

SITE TYPE: BORE | SITE ID: 93080 | SHEET 5 OF 8

DEPTH ft	DEPTH cm	SAMPLE INTERVAL	DESCRIPTION INTERVAL	RECOVERY (cm/cm)	DESCRIPTION (COLOR, TEXTURE, STRUCTURE)	ESTIMATED PERCENTAGE OF: VERY COARSE/GRAVEL	SAND: COARSE	SAND: MEDIUM	SAND: FINE	SILT/CLAY	SOIL CLASSIFICATION USCS	MOISTURE	CONSISTENCY/DENSITY	COLOR	COMMENTS (SAMPLE NUMBER)
					1616 TM										
49	1494				1494-1647 Same										
50	1525														
51	1555														
52	1586														
53	1616				1616-1753 Yellowish brn coarse sand w/ minor granules & v. coarse gravel clasts in zones, some medium, poorly sorted	10	60	25	-	5/5	GP	V moist	L	10YR 5/4	
54	1647														
55	1677														
56	1708														
57	1738														
	1753				1753 Water table. (approximate)							WET			
58	1769				1753-1799 Coarse sandy and granular gravel										
59	1799				1799-1952 Same percentages probably due to difficulty discerning grain size though plastic and water.										N8541
60	1830														
61	1860														
62	1891				Coarse to VCSE, sandy granular pebble gravel w/ few medium gravel clasts										

EBASCO SERVICES INCORPORATED
ENVIRONMENTAL PROGRAM AT ROCKY MOUNTAIN ARSENAL

FIELD LOG OF BORING

SITE TYPE: BORE | SITE ID: 33080 | SHEET 6 of 8

DEPTH ft	DEPTH cm	SAMPLE INTERVAL	DESCRIPTION INTERVAL	RECOVERY (cm/cm)	DESCRIPTION (COLOR, TEXTURE, STRUCTURE)	ESTIMATED PERCENTAGE OF: VERY COARSE / GRAVEL	SAND: COARSE	SAND: MEDIUM	SAND: FINE	SILT / CLAY	SOIL CLASSIFICATION USCS	MOISTURE	CONSISTENCY / DENSITY	COLOR	COMMENTS (SAMPLE TYPE, ETC.)
62	1891														
63	1921														
64	1952				Clay lens at tip 1952-2104 No recovery - Very fine sandy pebble gravel (assumed)										
65	1982														
66	2013														
67	2043														
68	2074														
69	2104			8'/15	2104-2257 Some gravel w/ less fines										
70	2135				No percentages recorded										
71	2165														
72	2196														
73	2226														
74	2257			95%	2257-2291 Same										
75	2287														

EBASCO SERVICES INCORPORATED
ENVIRONMENTAL PROGRAM AT ROCKY MOUNTAIN ARSENAL

FIELD LOG OF BORING

SITE TYPE: BORE | SITE ID: 33080 | SHEET 7 OF 8

DEPTH ft	DEPTH cm	SAMPLE INTERVAL	DESCRIPTION INTERVAL	RECOVERY (cm/cm)	DESCRIPTION (COLOR, TEXTURE, STRUCTURE)	ESTIMATED PERCENTAGE OF: VERY COARSE/GRAVEL	SAND: COARSE	SAND: MEDIUM	SAND: FINE	SILT/CLAY	SOIL CLASSIFICATION USCS	MOISTURE	CONSISTENCY/DENSITY	COLOR	COMMENTS (SAMPLE NUMBER)
-75	2287				2287-2409 silty fine sand minor med. + coarse if any.										
-76	2318														
-77	2348														
-78	2379														
-7.	10				90+% Layers of gravelly sand and fine [illegible] for sand										
-80	2440														
-81	2470														
-82	2501														
-83	2531														
-84	2562				90% FAIRLY UNIFORM FINE GRAINED SILTY SAND AT ≈87' MARK ABRUPT CHANGE TO CLAY. IN SHOE AT BOTTOM OF CORE SAMPLER NOTICED SOME LG. GRAINED SAND BEGINNG TO MIX IN W/ CLAY										
-85	2592														
-8.	2623														
-87	2653														
	2668														
-88	2684														

EBASCO SERVICES INCORPORATED
ENVIRONMENTAL PROGRAM AT ROCKY MOUNTAIN ARSENAL

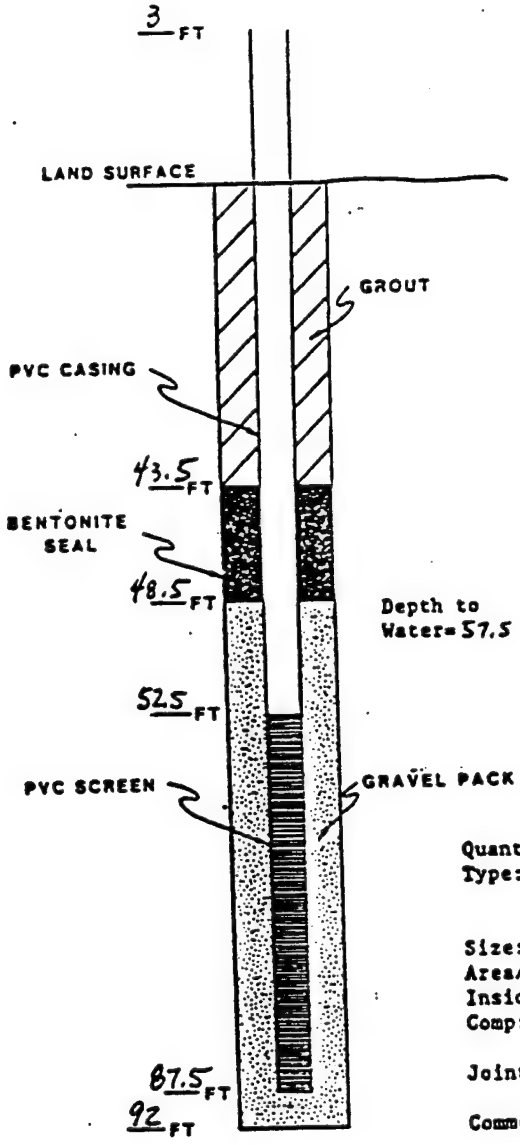
FIELD LOG OF BORING

SITE TYPE: BORE | SITE ID: 33080 | SHEET 8 OF 8

DEPTH ft	DEPTH cm	SAMPLE INTERVAL	DESCRIPTION INTERVAL	RECOVERY (cm/cm)	DESCRIPTION (COLOR, TEXTURE, STRUCTURE)	ESTIMATED PERCENTAGE OF: VERY COARSE / GRAVEL	SAND: COARSE	SAND: MEDIUM	SAND: FINE	SILT / CLAY	SOIL CLASSIFICATION USCS	MOISTURE	CONSISTENCY / DENSITY	COLOR	COMMENTS (SAMPLE NUMBER)
89	2714														
90	2745														
91	2775				Well set at 87.5' Drilled to 92'										
	2806				Bottom of hole										
93	2836														
94	2867														
95	2897														
96	2928														
97	2958														
98	2989														
	3019														
100	3050														
101	3080														

EBASCO SERVICES INCORPORATED
ENVIRONMENTAL PROGRAM AT ROCKY MOUNTAIN ARSENAL

WELL CONSRUCTION LOG



Measuring Point is Ground Surface unless otherwise noted

Task No.: 46 Geologist: NM
Well Number: 33080 Checked By: ____

Drilling Summary

Total Depth of Bore: 92 Ft.
Borehole Diameter: 11.25 in ~~Ft~~ mm
Drilling Company: Custom Auger
Driller: Frank Parks
Rig: CME 55
Bits: Hollow Stem Auger

Construction Time Log

	Start Date	Start Time	Finish Date	Finish Time
Drilling:	10/14	0829	10/21	1604
Screen Placement:	10/22	1000	10/22	1050
Filter Placement:	10/22	1050	10/22	1309
Seal Placement:	10/22	1500	10/22	1515
Grouting:	10/23	0900	10/23	1030

Well Construction Material

	Grout	Seals	Filter
Quantity:	3 batches *	2.25 buckets **	14 bags
Type:	1 ***	Volclay Pellets (Bentonite)	10-20 Colo. Silica Sand

Screen

Size: 0.020
Area/Ft.: 55
Inside diameter: 4"
Comp: PVC
Config: ____
Outside Diameter: 4.25"
Manufacturer: Ardvark
Joints and Centralizers: # Flush joint threaded

Comments: * 1 batch = 3.3 lb bentonite, 1a bags cement)
** 2 buckets = ¼" dia - Volclay pellets 0.25 buckets: ½ dia
*** Cement-bentonite mixture - Southwestern Portland Cement and Quick Gel Bentonite

R. L. STOLLAR & ASSOCIATES, INC.

WELL LOG

Project No. UCLA
Well/Boring No. 33085
Combo/Key No.

Project Name and Location: UCLA - West Tree	Elevation	Coordinates	Township / Range / Section: 33
Drilling Company: Custom Auger	Driller: F. Parks	Date and Time Started: 5/25/88 0830	Date and Time Completed: 5/31/88 1700
Drilling Equipment: CME-55		Total Drilled Depth: 86.5' BGS	Completion Depth: 86' BGS
Drilling Method: Hollow Stem Auger	Boring Diameter: 11" OD	Sampler	No. of Samples: Cal: SS
Size and Type of Casing: 4" SCH 40 FLUSH JOINT		Water Elevation: First: 55'	Completion: 24 Hrs
Type of Perforation: 20 SLOT From 5.1 To 86 (Ft BGS)		Pack Size and Type: 8/12 From 52 To 86.9 (Ft BGS)	
Type of Seal: BENTONITE GRANULES From 47 To 52 (Ft BGS)		Hydrogeologist: B. STEPHENSON	Checked By/Date

Depth (feet)	Description	USCS Symbol	Lithology	Piezometer Installation	Water Content	Estimate % of GR	SA	FI	Bore Cuttings	Remarks (Drill Rate, Odor, Sample No. etc.)
0	CLAYEY SILTY SAND									EASY DRILLING
	YELLOW-BRN.; POORLY SORTED SUBANGULAR; DRY TO MOIST;	SM TO SC				5	80	15		NO ODORS
5	W/SOME CALICHE @ 6' BGS; W/SOME GRAVEL LENSES @ 18-20' & 36-37'; ROOTS NEAR SURFACE									
10				CEMENT						
15				4" BLANK PVC						
20				CEMENT						
25										
30										
35										

FORM 472

Page 1 of 3

R. L. STOLLAR & ASSOCIATES, INC.

WELL LOG (Continued)

Project No. _____

Well/Boring No. 33085

Depth (feet)	Description	USCS Symbol	Lithology	Piezometer Installation	Water Content	Estimate % of GR	SA	FI	Blow Counts	Remarks (Drill Rate, Odor, Sample No. etc.)
37'	CLAY ; BROWN ; VERY PLASTIC ; MOIST	CL		CEMENT			5	95		TIGHT FRICTION
40				BENTONITE						
45				2" BLANK PVC						
50				CEMENT BENTONITE						
55	GRAVELLY COARSE SAND - WET; SUBANGULAR; POOR SORT LT. TAN BROWN; SOME SLT W/SOME FINE SANDS & COBBLES	SP		SAND	• 11	15	80	5	142/5	BEGIN W/PISTON SAMPLER
60									135/5	
65				SAND						
70										
75									233/5	FISHED FOR SAMPLER

FORM 7/3

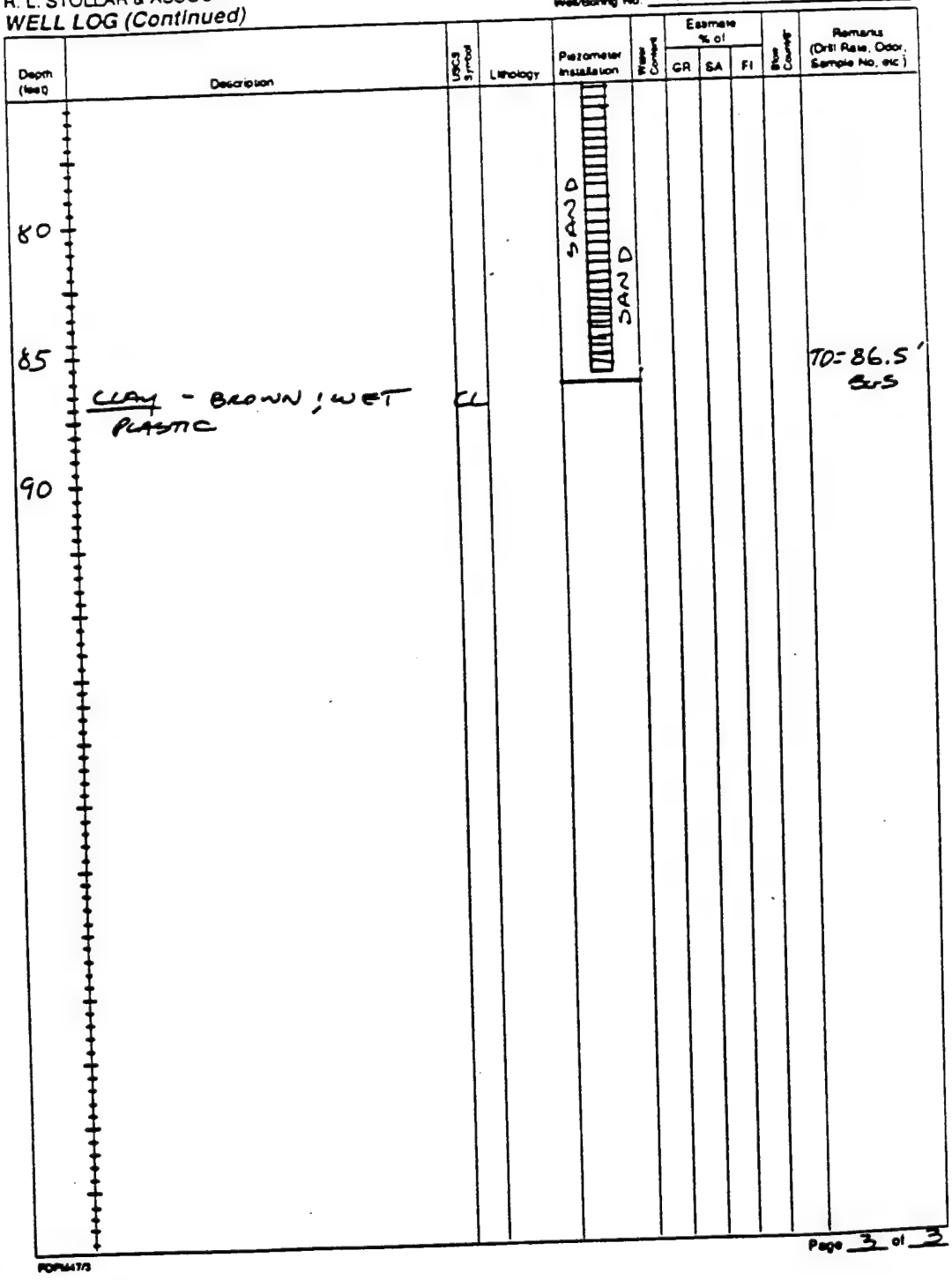
Page 2 of 3

R. L. STOLLAR & ASSOCIATES, INC.

Project No. _____

Well/Boring No. 33085

WELL LOG (Continued)



Page 3 of 3

FORM473

R. L. STOLLAR & ASSOCIATES, INC.
WELL LOG

Project No. UCLA
Well/Boring No. 530B6
Combo/Key No.

Project Name and Location: UCLA - WEST TRACT	Elevation	Coordinates	Township / Range / Section: 3S
Drilling Company: CUSTOM AUGER	Driller: F. PARKS	Date and Time Started: 3/26/88 1500	
Drilling Equipment: CME-55		Date and Time Completed: 5/27/88 1430	
Drilling Method: HOLLOW STEM AUGER	Boring Diameter: 11" OD	Total Drilled Depth: 90' BGS	Completion Depth: 86' BGS
Size and Type of Casing: 2" SCH 40 FLUSH JOINT		Sampler / No. of Samples	Cal: SS
Type of Perforation: 20 SLOT From 56 To 86 (Ft-BGS)		Water Elevation / First: 35'	Completion: 24 Hrs
Type of Seal: BENTONITE GRANULES From 49 To 54 (Ft-BGS)		Pack Size and Type: 8/12 From 54' To 5' (Ft-BGS)	
		Hydrogeologist: B. STEPHENSON	Checked By/Date

Depth (feet)	Description	USCS symbol	Lithology	Piezometer Installation	Water Content	Estimate % of GR	SA	FI	Blow Counts	Remarks (Drill Rate, Odor, Sample No. etc.)
0	CLAYEY SILTY SAND									EASY DRILLING
	YELLOW-BRN.; POORLY SORTED SUBANGULAR; DRY TO MOIST; W/SOME CALICHE @ 6' BGS; W/SOME GRAVEL LENSES @ 18-20' & 36-37'; ROOTS NEAR SURFACE	SM TO SC				5	80	15		NO ODORS
5										
10										
15										
20										
25										
30										
35										

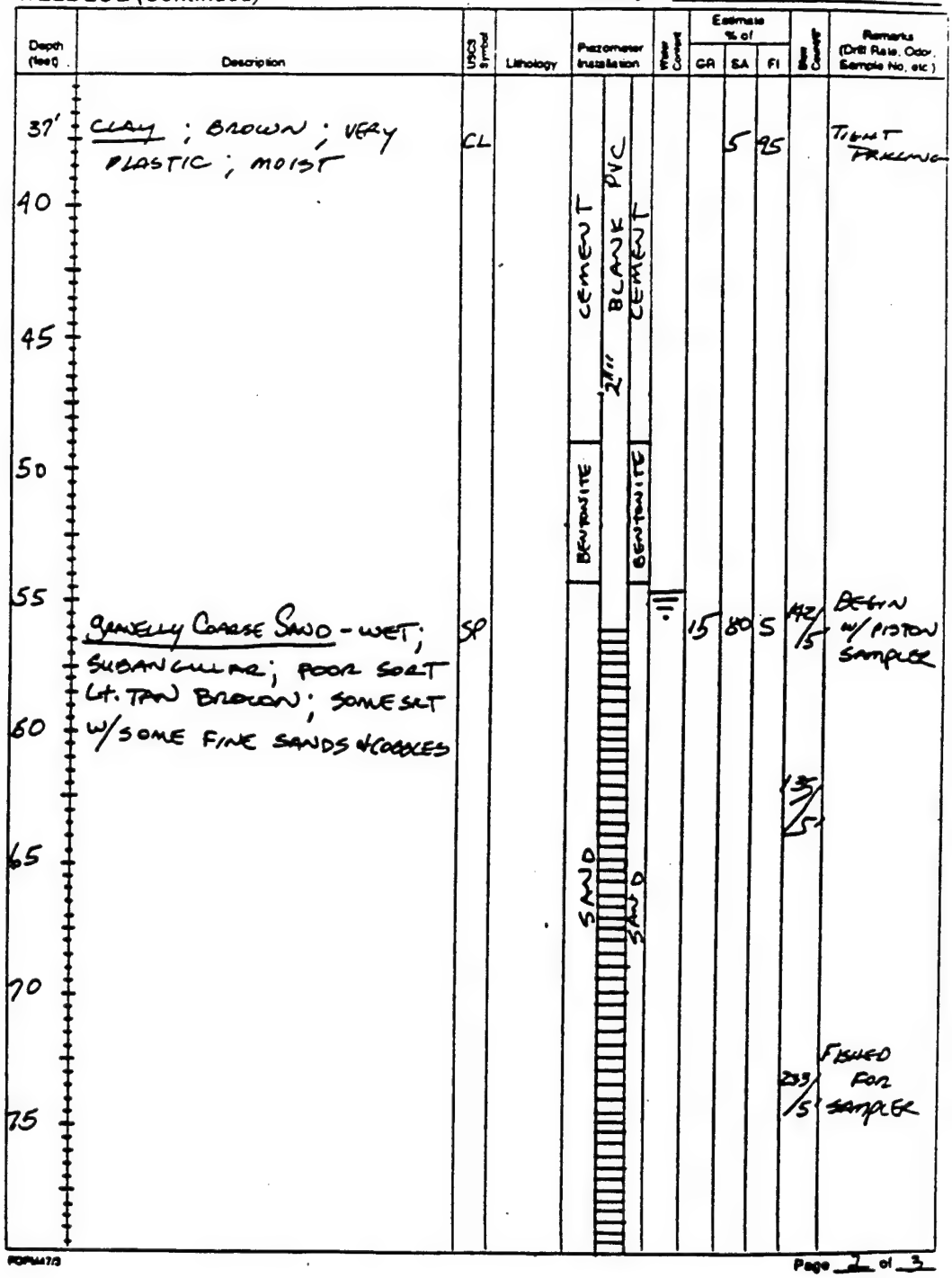
Piezometer Installation: CEMENT; 2" BLANK PVC; CEMENT

FORM 1V2

Page 1 of 5

R. L. STOLLAR & ASSOCIATES, INC.
WELL LOG (Continued)

Project No. _____
Well/Boring No. 33086



FORM 7/3

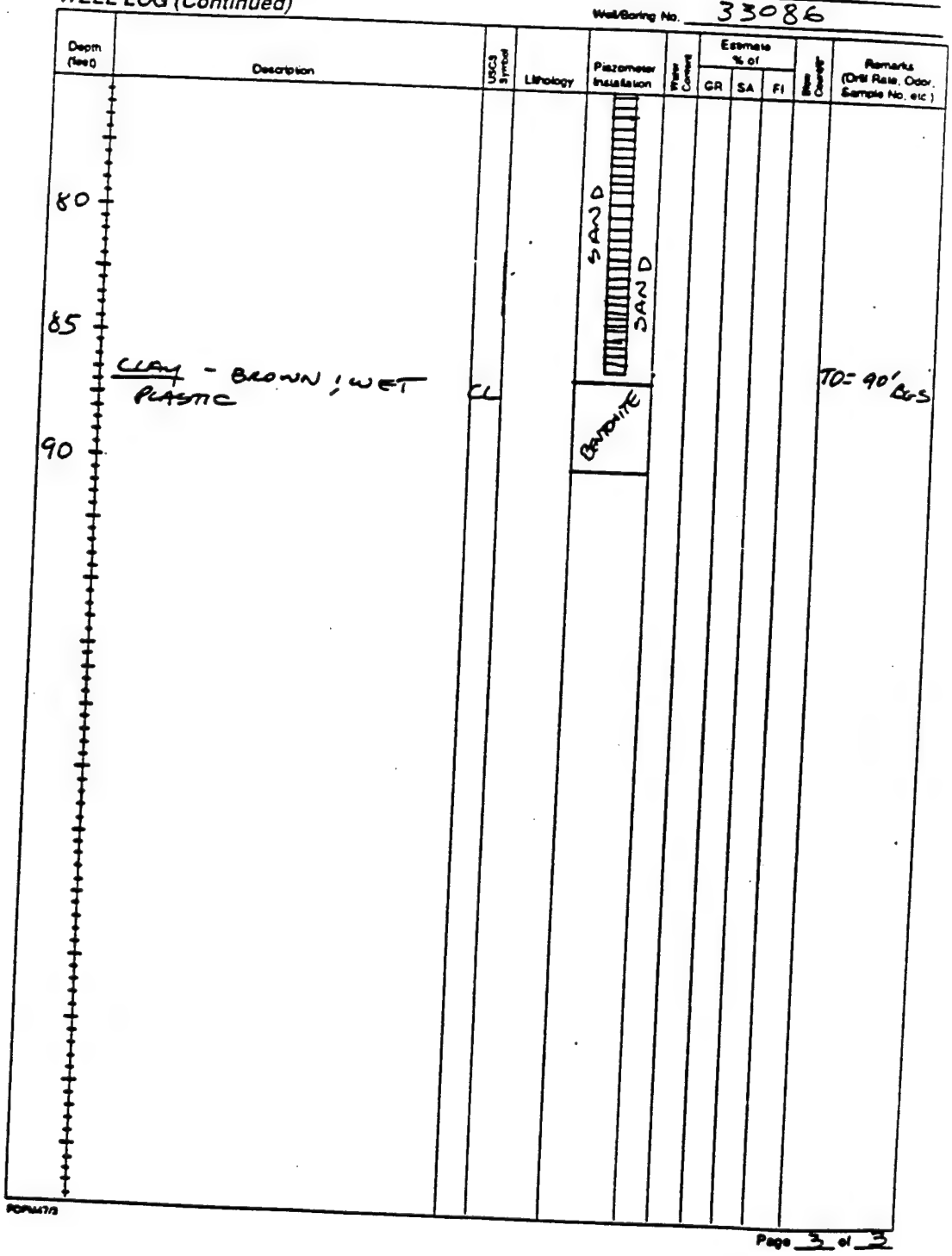
Page 2 of 3

R. L. STOLLAR & ASSOCIATES, INC.

WELL LOG (Continued)

Project No. _____

Well/Boring No. 33086



Page 3 of 3

R. L. STOLLAR & ASSOCIATES, INC.

WELL LOG

Project No. UCLA
Well/Boring No. 53087
Combo/Key No.

Project Name and Location: UCLA - WEST TREE	Elevation	Coordinates	Township	Range	Section: 33
Drilling Company: CUSTOM AUGER	Driller: F. PARKS	Date and Time Started: 8/31/88 0700			
Drilling Equipment: CME-55		Date and Time Completed: 8/31/88 1500			
Drilling Method: HOLLOW STEM AUGER	Boring Diameter: 10"	Total Drilled Depth: ~57' BGS		Completion Depth: 56' BGS	
Size and Type of Casing: SCH 40 FLUSH JOINT		Sampler	No of Samples	Cal	SS
Type of Perforation: 20 SLOT	From: 55.5 To: 66 (Ft-BGS)	Water Elevation	First	Completion	24 Hrs
Type of Seal: BENTONITE GRANULES	From: 49 To: 54. (Ft-BGS)	Pack Size and Type: NATIVE	From	To	(Ft-BGS)
		Hydrogeologist: S. STEPHENSON	Checked By/Date		

Depth (feet)	Description	USCS Symbol	Lithology	Piezometer Installation	Water Content	Estimate % of GR	SA	FI	Blow Count/ft	Remarks (Drill Rate, Odor, Sample No, etc.)
0	CLAYEY SILTY SAND									EASY DRILLING
	YELLOW-BRN.; POORLY SORTED; SUBANGULAR; DRY TO MOIST; W/SOME CALICHE @ 6' BGS; W/SOME GRAVEL LENSES @ 18-20' & 36-37'; ROOTS NEAR SURFACE	SM TO SC		CEMENT; 2" BLANK PVC; CEMENT		5	80	15		NO ODORS
5										
10										
15										
20										
25										
30										
35										

FORM 1/2

Page 1 of 2

R. L. STOLLAR & ASSOCIATES, INC.
WELL LOG (Continued)

Project No. _____
Well/Boring No. 33087

Depth (feet)	Description	USCS Symbol	Lithology	Piezometer Installation	Water Content	Estimate % of GR	SA	FI	Blow Counts	Remarks (Drill Rate, Odor, Sample No., etc.)
37'	CLAY ; BROWN ; VERY PLASTIC ; MOIST	CL		CEMENT			5	95		TIGHT DRILLING
40				BENTONITE						
45				2" BLANK PVC						
50				BENTONITE						
55	GRAVELLY COARSE SAND - WET; SUBANGULAR; POOR SORT LT. TAN BROWN; SOME SILT W/SOME FINE SANDS & COBBLES	SP		NATIVE STAINLESS NATIVE	•	15	80	5		
60										
65										
70										
75										

FORM 173

Page 2 of 2

APPENDIX D. SOLUTE CONCENTRATIONS IN WATER SAMPLES

ROCKY MOUNTAIN ARSENAL INJECTION-EXTRACTION EXPERIMENT
INJECTION WELL

SAMPLE	TIME (hr)	IODIDE (ppm)	TCA (ppb)	TCE (ppb)
I1	0.12	59.50	0.44	1.5
I2	0.95	62.10		
I3	1.40	49.76		
I4	1.70	53.50		
I5	2.65	60.60		
I6	2.75			
I7	3.47	60.50		
I8	5.20	57.90		
I9	6.35	59.40		
I10	7.22	61.12		
I11	7.77	54.30		
I12	9.00	15.60		
I13	10.00	56.10		
I14	10.35	57.70		
I15	11.33	55.20		
I16	13.17	65.00		
I17	14.77	62.40		
I18	16.90	59.80		
I19	18.4			
I20	19.40	70.50		
I21	20.50	61.20	0.32	1.42
I22	21.66			
I23	22.2			
I24	23.00	67.40		
I25	23.30			
I26	24.30	80.60		
I27	25.50	90.00		
I28	26.50	70.40		
I29	27.20	69.02		
I30	27.60	0.85		
I31	28.40	1.08		
I32	29.35			
I34	31.80	2.53		
I35	33.80	2.78		
I36	35.90			
I37	37.00			
I38	38.40	4.74		
I39	39.50		0.15	1.17
I40	40.50			
I41	41.60			
I42	42.70	6.44		
I43	43.8			
I44	44.8			
I45	45.80	7.41		
I46	46.8			
I47	47.80	8.90		
I48	48.9			
I49	49.90	10.00		

ROCKY MOUNTAIN ARSENAL INJECTION-EXTRACTION EXPERIMENT
INJECTION WELL

SAMPLE	TIME (hr)	IODIDE (ppm)	TCA (ppb)	TCE (ppb)
I50	50.90	10.50		
I51	51.90	9.90		
I52	53.10	10.40	0.6	1.01
I53	53.90	11.19		
I54	54.90	11.50		
I55	55.90	11.70		
I56	56.83			
I57	58.00	10.90		
I58	59			
I59	60.00	10.60		
I60	61.3			
I61	62.30	10.20		
I62	63.50	10.20		
I63	64.56			
I64	65.60	9.20		
I65	66.53			
I66	67.40	8.86		
I67	68.33			
I68	69.30	8.38		
I69	70.35			
I70	71.40	7.50		
I71	72.38			
I72	73.30	7.00		
I73	74.33			
I74	75.50	6.70		
I75	76.58			
I76	77.60	5.30		
I77	78.6			
I78	79.60	5.85		
I79	80.71		0	0.86
I80	82.10	4.62		
I81	84.16			
I82	86.35			
I83	88.40	3.65		
I84	90.41			
I85	92.30	3.61		
I86	94.38			
I87	96.30	3.30		
I88	98.35			
I89	100.30	3.30	0	0.79
I90	104.43			
I91	108.60	2.46		
I92	112.5			
I93	116.50	1.95		
I94	120.33		0	0.82
I95	124.30	1.70		
I96	129.00	1.40		
I97	133			

ROCKY MOUNTAIN ARSENAL INJECTION-EXTRACTION EXPERIMENT
INJECTION WELL

SAMPLE	TIME (hr)	IODIDE (ppm)	TCA (ppb)	TCE (ppb)
I98	137.10	1.30		
I99	141.13		0	0.77
I100	145.10	1.10		
I101	149.13			
I102	153.10	0.94		
I103	157.10	0.90		
I104	161.20	0.80	0	0.75
I105	165.75			
I106	171.40	0.70		
I107	175.43			
I108	179.58			
I109	183.4			
I110	187.58	0.71		
I111	191.88			
I112	195.5			
I113	199.71			
I114	204.35		0	0.7
I115	208.25			
I116	212.36			
I117	216.61	0.46		
I118	220.58			
I119	224.2		0	0.69
I120	230.13			
I121	236.35	0.38		
I122	242.38	0.34		
I123	254.40	0.30		
I124	266.3		0	0.79
I125	278.45			
I126	290.26			
I127	302.2		0	0.58
I128	315.85			
I129	332.63			
I130	357.66		0.07	0.92
I131	405.83		0	0.53
I132	431.83		0.25	1.14
I133	477.55			
I134	501.96			
I135	535.26			
I136	630.18		0	0.47
I137-A	652.65		1	1
I137	652.65		0.01	0
I138	701.45			
I139	769.05		0	0.45
I140	821.50			
I141	864.90			
I142	944.70		0	0.47
I143	991.70			
I144	1033.40			
I145	1104.00		0	0.41

ROCKY MOUNTAIN ARSENAL INJECTION-EXTRACTION EXPERIMENT
DRIVE POINT A

SAMPLE	TIME (hr)	IODIDE (ppm)	TCA (ppb)	TCE (ppb)
A1	1.37		37.306	44.513
A2	3.90	0.01		
A3	7.40	0.01	34.134	40.79
A4	8.57			
A5	10.60	0.54		
A5	10.6		35.494	42.5
A6	12.55		32.801	40.886
A7	14.90	7.37		
A8	17.1	11.83	28.557	36.03
A9	18.30	13.9		
A10	19.50	21.4		
A11	20.60	19.6	24.727	33.009
A12	21.75	21.8		
A13	23.20	25.67		
A14	24.4	27.4	17.879	25.194
A15	25.50	32.26		
A16	26.50	38		
A17	28.30	36.96	13.585	18.89
A18	29.50	39.9	11.768	16.791
A19	31.80	44.6		
A20	33.90	46.6	6.494	9.799
A22	37.1		6.614	10.044
A23	38.40	49.8		
A24	39.60		5.324	7.993
A25	40.80			
A26	42.10	51.7		
A27	42.90	45.8		
A28	44.2	50.5	3.835	5.4
A29	45.20			
A30	46.2	46.8	3.261	4.597
A31	47.20	47.3		
A32	48.3	44.6	3.324	4.771
A33	49.30	45.3		
A34	50.30	42.5	2.487	3.867
A35	51.40	40.7		
A36	52.50	36.6	2.776	4.224
A37	53.50			
A38	54.60	36.93	2.51	4.093
A39	55.40	34.34		
A40	56.80	26.4	2.465	3.995
A41	57.60	23.6		
A42	58.60	24.2		
A43	59.70	21.15		
A44	60.93		1.814	3.022
A45	61.80	16.6		
A46	62.80	15.6	1.806	2.988
A47	63.90	14.2		
A48	64.80	12.9	1.799	2.918

ROCKY MOUNTAIN ARSENAL INJECTION-EXTRACTION EXPERIMENT
DRIVE POINT A

SAMPLE	TIME (hr)	IODIDE (ppm)	TCA (ppb)	TCE (ppb)
A49	65.70	10.9		
A50	66.80	11.7		
A51	67.64	11.2	1.463	2.54
A52	68.70	11		
A53	69.70	10.9		
A54	70.90	10.9	1.789	3.1
A55	71.90	9.1		
A56	72.90	10.5	1.416	2.559
A57	73.90	10.3		
A58	75.10	10.2		
A59	76.50	9.1		
A60	77.30	9.1	2.361	3.888
A61	78.50	10.6		
A62	79.40	10.3	2.323	3.799
A63	80.40	10.6		
A64	82.33		2.761	4.548
A65	84.60	9		
A66	86.38		2.123	3.661
A67	88.30	9.1		
A68	90.38		2.141	3.61
A69	92.40	9.1		
A70	94.48			
A71	96.50	8.28	2.151	3.609
A72	98.53			
A73	100.60	7.7	2.136	3.517
A74	104.80	6.8		
A75	108.50	5.5	1.757	3.044
A76	112.70	4.7		
A77	116.90	3.99	2.402	3.648
A78	120.30	3.83		
A79	124.30	3.4	2.503	3.771
A80	129.10	2.8		
A81	133.00	2.3	2.763	4.045
A82	137.20	2.3		
A83	140.90	2.1	2.652	3.86
A84	144.60	2.1		
A85	148.70	1.8	2.76	4.173
A86	152.70	1.6		
A87	156.70	1.7	2.934	4.55
A88	160.70	1.6		
A89	165.81		3.332	5.007
A90	171.50	1.2		
A91	175.55		3.483	5.236
A92-A	179.80	1.1	2.7	3.8
A93	183.65		3.715	5.487
A94-A	187.40	0.95	2.7	3.9
A95	191.36			

ROCKY MOUNTAIN ARSENAL INJECTION-EXTRACTION EXPERIMENT

DRIVE POINT A

SAMPLE	TIME (hr)	IODIDE (ppm)	TCA (ppb)	TCE (ppb)
A96	195.13		3.508	5.238
A97	199.36	0.77		
A98	204.41			
A99	208.45	0.67		
A100	212.55		5.2	8.2
A101	216.71	0.62		
A102	220.56		3.933	6.137
A103	224.23	0.6		
A104	230.31		3.947	6.059
A105	236.58	0.49		
A106	242.53	0.41	4.263	6.512
A107	254.56	0.36		
A108	266.46		4.286	6.708
A109	278.63			
A110	290.35	0.1	4.5	8.2
A111	302.28			
A112	315.96		10.336	14.636
A113	326.25			
A114	342.33	0.07	4.865	7.306
A115	357.81		4.41	7.12
A116	388.33			
A117	406.00		9.1	13.7
A118	429.91			
A119	477.53		12.078	17.93
A120	502.05			
A121	535.30		12.953	18.385
A122	607.91		36.758	44.381
A123	630.16		38.102	48.688
A124-A	652.41		17.6	37.8
A124	652.41		25.998	35.527
A125	944.75			
A126	769.05			
A127	821.50			
A128	864.90			

ROCKY MOUNTAIN ARSENAL INJECTION-EXTRACTION EXPERIMENT
DRIVE POINT B

SAMPLE	TIME (hr)	IODIDE (ppm)	TCA (ppb)	TCE (ppb)
B1	1.63		44.21	50.46
B2	4.00	0.01		
B3	6.5		42.41	47.23
B4	8.68			
B5	10.80	0.01		
B6	13.4		37.77	42.7
B7	15.40	0.01		
B8	18.40	0.02	49.35	56.00
B9	21.91			
B10	24.00	0.02		
B11	26.06			
B12	29		39.96	44.82
B13	31.90	0.15		
B14	34.05	0.2		
B15	37.31			
B16	38.55		42.09	47.55
B17	40.93			
B18	42.83		39.86	46.41
B19	44.80	0.3		
B20	46.86			
B21	49		38.81	45.77
B22	51.03			
B23	53.30	0.3		
B24	54.83			
B25	57.03		41.83	48.11
B26	58.95			
B27	61.05			
B28	63.30	0.2	40.57	46.43
B29	65.35			
B30	67.30	0.13		
B31	69.30	0.14	36.98	43.28
B32	71.35			
B33	73.41			
B34	75.66		36.9	43.96
B35	77.50	0.1		
B36	79.98			
B37	83.70	0.1		
B38	87.35		37.79	42.97
B39	91.35			
B40	95.40	0.06	37.49	43.94
B41	99.56			
B42	103.70	0.04		
B43	107.56		40.52	47.82
B44	111.43			
B45	115.41			
B46	118.40	0.02		
B47	120.50	0.03	29.51	18.86
B48	124.83			

ROCKY MOUNTAIN ARSENAL INJECTION-EXTRACTION EXPERIMENT
DRIVE POINT B

SAMPLE	TIME (hr)	IODIDE (ppm)	TCA (ppb)	TCE (ppb)
B49	129.20	0.02		
B50	133.18			
B51	137.30	0.02		
B52	141.08		39.73	45.62
B53	144.80	0.02		
B54	148.81			
B55	152.90	0.02		
B56	156.80	0.02		
B57	160.90	0.01	40.63	46.46
B58	165.93			
B59	171.60	0.01		
B60	175.65			
B61-A	179.90	0.01	28.20	32.20
B62	183.8		41.1	48.89
B63-A	187.60	0.01	30.10	34.80
B64	191.51			
B65	195.23			
B66	199.48			
B67	204.53		39.12	45.8
B68	208.58			
B69	212.66			
B70	216.83	0.01		
B71	220.7		40.7	47.75
B72	222.36	0.01		
B73	230.41			
B74	236.68	0.01		
B75	242.63	0.01	41.07	47.46
B76	248.20	0.01		
B77	254.70	0		
B78	260.98	0.02		
B79	266.55			
B80	272.36	0.01		
B81	278.75		39.59	47.41
B82	284.53	0.01		
B83	290.48	0.01		
B84	296.7			
B85	302.4		40.54	48.01
B86	308.3		41.45	48.2
B87-A	316.08	0.01	21.40	42.20
B87	316.08		40.17	47.96
B88	320.68		41.38	49.91
B89	326.36	0.01	41.75	49.26
B90-A	332.5		22.7	48.8
B91	342.46		41.12	47.4
B92	357.93		41	48.79
B93	388.33		42.69	50.64
B94	406.33		40.54	48.27
B95	432.16		43.22	52.03

ROCKY MOUNTAIN ARSENAL INJECTION-EXTRACTION EXPERIMENT
DRIVE POINT B

SAMPLE	TIME (hr)	IODIDE (ppm)	TCA (ppb)	TCE (ppb)
B96	477.65			
B97	502.16			
B98	535.53		38.775	48.572
B99	607.96		41.18	46.85
B100	630.28		40.952	50.102
B101-A	652.55		22.40	47.20
B102	701.45		40.16	47.78
B103	769.10		39.25	46.69
B104	797.45		39.56	47.12
B105	821.47			
B106	864.90		38.78	46.57
B107	945.00		38.97	46.10
B108	991.70		39.06	46.48
B109	1033.40		41.00	49.88
B110	1104.8		39.68	49.35
B111	1179.2		40.54	49.32
B112	1213		35.82	43.71
B113	1216.77		36.85	50.03
B114	1222.3		40.94	49.06
B115	1225.5		42.11	51.23
B116	1228.2		44.18	53.15
B117	1231.4		40.37	49.57
B118	1234.7		37.06	45.83
B119	1236		36.52	44.36
B120	1237		33.46	40.48
B121	1238.1		31.64	38.81
B122	1239.5			
B123	1240.9		34.57	41.51
B124	1242.8			
B125	1244.7		33.67	39.74
B125	1244.7			
B126	1247.3		31.97	37.9
B127	1249.5		32.76	40.16
B128	1251.5		33.82	40.72
B129	1254.1		34.96	43.37
B130	1257.3		33.26	44.78
B131	1260.8		32.91	39.77
B132	1263.9		32.75	39.56
B133	1266.43		31.5	37.46
B134	1270.95			
B135	1274.1			
B136	1276		33.19	39.78

ROCKY MOUNTAIN ARSENAL INJECTION-EXTRACTION EXPERIMENT
DRIVE POINT C

SAMPLE	TIME (hr)	IODIDE (ppm)	TCA (ppb)	TCE (ppb)
C1	2.1		30.74	25.99
C2	4.15	0.02		
C3	6.63		33.08	27.85
C4	8.8			
C5	10.90	0.01		
C6	13.5		31.33	26.59
C7	15.50	0.04		
C8	18.50	0.01	32.18	27.22
C9	22.08			
C10	24.20	0.01	34.69	29.59
C11	26.2			
C12	29.76			
C13	32.00	0.01	34.46	29.36
C14	37.33		30.62	27.32
C15	39.78			
C16	42.25		32.73	28.76
C17	44.60	0.01		
C18	46.58			
C19	48.58		33.82	29.51
C20	50.63			
C21	53.03		32.81	29.31
C22	54.46			
C23	56.60	0.03	34.26	30.07
C24	58.73			
C25	61.16		35.95	32.39
C26	63.4			
C27	65.5		32.42	29.08
C28	67.40	0.02		
C29	69.50	0.02	33.58	30.38
C30	71.51			
C31	73.56		31.39	28.89
C32	75.86			
C33	77.80	0.02	34.19	31.44
C34	79.8			
C35	83.53		33.41	31.1
C36	87.20	0.01		
C37	91.2		33.56	32.06
C38	95.30	0.04		
C39	99.48		33.34	31.96
C40	103.60	0.08		
C41	107.45		33.88	33.26
C42	111.55			
C43	115.50	0.24	34.92	34.21
C44	118.5			
C45	120.80	0.62	34.07	33.48
C46	125.00	1.22		
C47	129.30	1.64	32.81	31.74
C48	133.30	2		

ROCKY MOUNTAIN ARSENAL INJECTION-EXTRACTION EXPERIMENT
DRIVE POINT C

SAMPLE	TIME (hr)	IODIDE (ppm)	TCA (ppb)	TCE (ppb)
C49	137.40	2.3	30.80	30.33
C50	141.20	2.7		
C51	144.90	3.2	29.39	28.66
C52	148.90	3.96		
C53	153.00	4.8	25.06	24.65
C54	156.90	4.9		
C55	161.00	5.3	21.40	20.8
C56	166.00	5.24		
C57	170.00	5.6		
C58	171.80	5.8		
C59-A	175.70		12.20	11.1
C60	180.10	5.7	13.68	13.57
C61	183.91			
C62-A	187.80	5.38	9.40	8.4
C62	187.8		10.62	10.42
C63	191.7			
C64	195.30	4.3	7.73	7.89
C65	199.55	4.51		
C66	204.63		7.45	7.64
C67	208.60	3.89		
C68	212.75		6.43	6.64
C69	216.80	3.3		
C70	220.8		5.36	5.64
C71	224.46	2.88		
C72	230.55		4.76	4.96
C73	236.80	2.38		
C74	242.80	1.96	3.96	4.25
C75	248.30	1.82		
C76	254.80	1.66	3.34	3.61
C77	261.10	1.62		
C78	266.68	1.57	2.75	3.08
C79	272.46			
C80	278.88		2.44	2.71
C81	284.63	1.21		
C82	290.58		2.01	2.43
C83	296.85			
C84	302.51		2.1	2.49
C85	308.43			
C86-A	316.21		2.00	2.5
C86	316.21		3.23	3.56
C87	320.8			
C88	326.50	1.28		
C89-A	332.58		1.30	2.3
C90	342.56	0.47	1.81	2.19
C91	358.01			
C92	388.33	0.19		
C93	406.33		1.07	1.39
C94	432.25	0.12		

ROCKY MOUNTAIN ARSENAL INJECTION-EXTRACTION EXPERIMENT
DRIVE POINT C

SAMPLE	TIME (hr)	IODIDE (ppm)	TCA (ppb)	TCE (ppb)
C95	477.73			
C96	502.26	0.16	1.36	1.62
C97	535.65		1.82	2.04
C98	608.06	0.09	1.091	1.181
C99	630.4		1.125	1.206
C99	630.4		0.89	1.36
C100-A	652.66		1.00	1
C99(MISL)	652.66		0.98	1.103
C100	701.45	0.07		
C101	769.05			
C102	821.50	0		
C103	864.90	0		
C104	945.10			
C105	991.9			
C106	1033.4	0		
C107	1104.96	0		
C108	652.66			
C109	1179.3	0		

ROCKY MOUNTAIN ARSENAL INJECTION-EXTRACTION EXPERIMENT
DRIVE POINT D

SAMPLE	TIME (hr)	IODIDE (ppm)	TCA (ppb)	TCE (ppb)
D1	2.18		26.01	17.02
D2	4.30	0.41		
D3	6.70	0.34	23.67	15.41
D4	8.90	0.33		
D5	11	0.3	25.22	16.21
D6	12.67			
D7	15.7	0.33	23.76	15.47
D8	17.18			
D9	18.65			
D10	19.60	0.34	22.09	14.28
D11	20.71			
D12	22.10	0.3	22.94	15.26
D13	23.31			
D14	24.60	0.3		
D15	25.61			
D16	26.70	0.29	24.58	16.05
D17	29.60	0.28		
D18	32.30	0.28		
D19	34.20	0.31	23.35	15.08
D20	37.5			
D21	39.88			
D22	42.30	0.24	25.20	16.16
D23	44.70	0.21		
D24	46.68			
D25	48.75		26.35	17.1
D26	50.70	0.22		
D27	53.11			
D28	54.68			
D29	56.88		26.6	17.11
D30	58.81			
D31	61.16			
D32	63.50	0.26	25.02	15.81
D33	65.6			
D34	67.50	0.42		
D35	69.60	0.6	23.27	14.58
D36	71.6			
D37	73.66			
D38	75.95		23.2	15.3
D39	78.00	1.6		
D40	80.13			
D41	83.80	3.2		
D42	84.85		23.02	14.47
D43	87.80	4.06		
D44	89.81		18.56	12.02
D45	91.90	5.44		
D46	94.01		21.55	13.85
D47	96.00	6.3		
D48	98.00	5.97	20.62	12.99

ROCKY MOUNTAIN ARSENAL INJECTION-EXTRACTION EXPERIMENT
DRIVE POINT D

SAMPLE	TIME (hr)	IODIDE (ppm)	TCA (ppb)	TCE (ppb)
D49	100.03			
D50	103.80	6.7	22.72	13.74
D51	107.60	5.9		
D52	111.60	5.9	21.01	13.46
D53	115.60	5.7		
D54	118.60	6.5	20.95	13.30
D55	121.50	3.9		
D56	125.40	6.8	20.95	13.71
D57	129.50	5.53		
D58	133.30	5.2	20.73	13.29
D59	137.50	4.8		
D60	141.30	4.7	18.17	11.85
D61	145.00	4.6		
D62	149.00	4.1	15.31	9.86
D63	153.10	3.8		
D64	157.10	4.3	15.24	10.11
D65	161.10	4.1		
D66	166.10	3.7	14.08	9.30
D67	170.10	3.1		
D68	171.90	3	14.01	9.26
D69-A	175.83		10.00	5.70
D70	180.20	2.92	14.57	9.66
D71	184			
D72-A	188.00	2.76	10.20	5.90
D72	188		11.51	7.69
D73	191.8			
D74	195.40	2	11.74	7.78
D75	199.66			
D76	204.71		10.91	7.46
D77	208.80	1.97		
D78	212.85		10.43	7.26
D79	217.01	1.8		
D80	220.9		10.01	6.85
D81	224.33	1.67		
D82	230.63		8.82	6.17
D83	236.83	1.5		
D84	242.88	1.32	8.36	5.87
D85	248.33	1.15		
D86	254.91	1.21	8.50	5.99
D87	261.23	1.2		
D88	266.78		7.34	5.03
D89	272.33			
D90	278.98		6.53	4.6
D91	284.75	1.01		
D92	290.71		5.76	4.17
D93	296.91			
D94	302.6		5.48	4
D95	308.5	0.49		

ROCKY MOUNTAIN ARSENAL INJECTION-EXTRACTION EXPERIMENT
DRIVE POINT D

SAMPLE	TIME (hr)	IODIDE (ppm)	TCA (ppb)	TCE (ppb)
D96-A	316.30		2.90	3.50
D97	320.86		5.34	3.89
D98	326.33	1.08		
D99-A	332.66		4.00	4.70
D99	332.66		6.13	4.39
D100	342.65			
D101	358.13	0.29	5.2	3.79
D102	388.33			
D103	406.33	0.34	4.14	3.02
D104	432.36	0.31		
D105	477.83			
D106	502.35	0.15		
D107	535.7			
D108	608.16	0.13	0.772	0.419
D109	630.45			
D110-A	652.75		1.00	1.00
D110	652.75	0.1	0.37	0.17
D111	864.9	0		
D112	701.4	0		
D113	945.2			
D114	991.9			
D115	1033.4	0		
D116	1105			

ROCKY MOUNTAIN ARSENAL INJECTION-EXTRACTION EXPERIMENT
FULLY PENETRATING MONITORING WELL

SAMPLE	TIME (hr)	IODIDE (ppm)	TCA (ppb)	TCE (ppb)
ML1	2.47	0.01		
MM1	2.83	0.02		
MU1	6.23	0.06		
M3	7.40	0.31	30.68	40.25
M4	9.70	1.71		
M5	11.70	4.90		
M6	13.30	7.30	28.47	36.06
M7	14.80	11.80		
M8	16.95	20.03	23.10	29.76
M9	18.15	23.10		
M10	19.30	25.20		
M11	20.4	28.8	19.378	24.519
M12	21.60	32.30		
M13	23.70	35.50	16.03	20.21
M14	25.40	36.60		
M15	26.70	32.60		
M16	28.80	35.60		
M17	31.65	38.20	13.15	16.86
M18	33.20	46.60		
M19	35.40	48.90	9.72	12.55
M20	36.9			
M21	38.80	33.05		
M22	40.30	41.70	7.33	9.49
M23	42.00	32.80		
M24	43.50	29.60	8.93	11.69
M25	45.10	18.90		
M26	46.20	22.20	10.40	13.18
M27	47.50	18.10		
M28	49.00	17.52		
M29	50.20	15.76		
M30	51.40	16.30		
M31	52.70	14.40	10.44	13.53
M32	54.10	15.55		
M33	55.30	15.68	7.87	10.27
M34	56.20	14.57		
M35	57.50	13.90		
M36	58.40	11.49		
M37	59.70	11.90	9.76	12.54
M38	60.80	10.20		
M39	61.80	10.10		
M40	63.00	9.20		
M41	64.00	10.70	8.76	11.30
M42	65.00	10.50		
M43	66.20	8.80	9.89	12.86
M44	67.10	9.70		
M45	67.9	8.8	9.111	11.898
M46	69.00	9.70		
M47	70.40	8.80	8.12	10.30

ROCKY MOUNTAIN ARSENAL INJECTION-EXTRACTION EXPERIMENT
FULLY PENETRATING MONITORING WELL

SAMPLE	TIME (hr)	IODIDE (ppm)	TCA (ppb)	TCE (ppb)
M48	71.80	8.90		
M49	77.30	9.20	7.10	9.04
M50	79.00	10.30		
M51	80.50	9.80	5.05	6.55
M52	81.70	9.50		
M53	84		3.987	5.35
M54	86.80	6.61		
M55	89.1		7.774	9.849
M56	92.00	6.20		
M57	94.66		6.097	7.939
M58	96.70	5.94		
M59	99.33		5.673	7.613
M60	104.60	4.90		
M61	108.28		4.916	7.084
M62	112.43			
M63	116.80	3.20	3.78	5.43
M64	121.68			
M65	125.50	2.40	9.60	12.65
M66	129.60	2.10		
M67	133.63		9.263	12.164
M68	137.60	1.70		
M69	141.8		9.391	12.612
M70	145.30	1.30		
M71	149.33		7.87	10.667
M72	153.30	1.10		
M73	157.30	1.20	10.42	13.99
M74	161.00	1.10		
M75	166.1			
M76	171.80	0.80	10.72	14.40
M77-A	175.70		9.70	11.00
M78	179.80	0.81	12.09	16.00
M79	183.73			
M80-A	187.66	0.71	10.30	11.40
M80	187.66		11.863	15.299
M81	191.66			
M82	195.63		9.767	13.062
M83	199.68	0.59		
M84	204.66		11.501	14.895
M85	208.55		15.40	18.75
M86	212.51	0.51	10.60	14.44
M87	216.66			
M88	220.85		11.215	15.163
M89	224.40	0.42		
M90	230.46		11.106	14.568
M91	236.55	0.38		
M92	242.58	0.31	11.22	14.92
M93	254.60	0.27		
M94	266.61		11.681	15.333

ROCKY MOUNTAIN ARSENAL INJECTION-EXTRACTION EXPERIMENT
FULLY PENETRATING MONITORING WELL

SAMPLE	TIME (hr)	IODIDE (ppm)	TCA (ppb)	TCE (ppb)
M95	278.68		15.30	19.14
M96	290.63		10.985	15.12
M97	302.46			
M98	316.11		11.792	15.72
M99	326.33		12.213	15.97
M100	342.50		13.90	17.25
M101	357.95			
M102	406.1		12.548	16.83
M103	432.08			
M104	477.76			
M105	502.23			
M106	535.56		13.18	17.79
M107	608.03		20.289	25.0915
M108	630.31		17.01	21.57
M109-A	652.70		8.60	17.50
M109	652.70		15.14	19.52
M110	701.50			
M111	769.10			
M112	821.50			
M113	864.90			
M114	944.90			
M115	992.10			
M116	1033.40			
M117	1105.10			
M118	1179.30			

ROCKY MOUNTAIN ARSENAL INJECTION-EXTRACTION EXPERIMENT
EXTRACTION WELL

SAMPLE	TIME (hr)	IODIDE (ppm)	TCA (ppb)	TCE (ppb)
S1	0.36	0.04	37.14	40.09
S2	2.75			
S3	6.40	0.05		
S4	10.4			
S5	13.22			
S6	14.80	0.08		
S7	16.93			
S8	18.30	0.15		
S9	19.43			
S10	20.6			
S11	21.66			
S12	22.2			
S13	23.00	0.27		
S14	24.20	0.43	35.85	38.73
S15	25.60	0.65		
S16	26.60	0.77		
S17	27.63			
S18	28.47	1.22		
S19	29.35	1.57		
S21	31.70	2.3		
S22	33.80	2.91		
S23	35.9			
S24	37.00	4.2		
S25	38.5			
S26	39.60	4.99	31.47	34.33
S27	40.6			
S28	41.6			
S29	42.70	6.28		
S30	43.8			
S31	44.80	7		
S32	45.8			
S33	46.9			
S34	47.90	8.26		
S35	48.90	8.3		
S36	49.9			
S37	50.90	9.58		
S38	51.90	9.4		
S39	53.10	9.72		
S40	53.90	11.07		
S41	54.90	10.98		
S42	56.00	11.16		
S43	56.83			
S44	58.00	10.37		
S45	59			
S46	60.31		30.91	34.58
S47	61.30	10.4		
S48	62.35			
S49	63.60	9.52		

ROCKY MOUNTAIN ARSENAL INJECTION-EXTRACTION EXPERIMENT
EXTRACTION WELL

SAMPLE	TIME (hr)	IODIDE (ppm)	TCA (ppb)	TCE (ppb)
S50	64.55			
S51	65.60	9.1		
S52	66.51			
S53	67.40	8.6		
S54	68.33			
S55	69.40	8.2		
S56	70.4			
S57	71.40	7.4		
S58	72.41			
S59	73.40	6.7		
S60	74.41			
S61	75.50	6.3		
S62	76.58			
S63	77.70	5.6		
S64	78.68			
S65	79.60	5.53		
S66	80.63		29.2	32.65
S67	82.20	5.1		
S68	84.50	3.91		
S69	86.35			
S70	88.30	3.71		
S71	90.4			
S72	92.30	3.41		
S73	94.38			
S74	96.40	3.3		
S75	98.45			
S76	100.50	3.1	27.04	30.75
S77	104.51			
S78	108.50	2.27		
S79	112.4			
S80	116.40	1.92		
S81	120.60	1.19		
S82	124.65			
S83	129.10	1.44		
S84	133.11			
S85	137.10	1.1		
S86	141.25		28.18	31.47
S87	145.20	0.99		
S88	149.26			
S89	153.20	0.85		
S90	157.20	0.9		
S91	161.30	0.8	28.13	31.48
S92	166.2			
S93	171.50	0.7		
S94	175.46			
S95	179.68			
S96	183.46		27.57	31.06
S97	187.76			

ROCKY MOUNTAIN ARSENAL INJECTION-EXTRACTION EXPERIMENT
EXTRACTION WELL

SAMPLE	TIME (hr)	IODIDE (ppm)	TCA (ppb)	TCE (ppb)
S98	191.91	0.54		
S99	195.58			
S100	199.73			
S101	204.35		27.61	31.92
S102	208.31			
S103	212.41			
S104	216.83	0.42		
S105	220.63		28.74	32.69
S106	224.55			
S107	230.18			
S108	236.41	0.37		
S109	242.41	0.31	28.37	32.96
S110	254.41	0.29		
S111	266.33			
S112	278.5			
S113	290.3		27.71	32.37
S114	302.23			
S115	315.91			
S116	332.43			
S117	357.68		28.27	33.11
S118	405.83			
S119	431.83		32.00	36.10
S120	477.56		28.05	32.79
S121	501.95		27.97	32.69
S122	535.23		26.791	32.024
S123	630.2		31.17	36.55
S124-A	652.61		16.50	31.60
S124	652.61		29.79	36.16
S125	701.45			
S126	769.05		24.91	29.35
S127	821.47			
S128	864.92			
S129	944.63		24.95	29.70
S130	991.72			
S131	1033.40			
S132	1104.00		22.68	27.62

APPENDIX E. CALCULATIONS OF PULSE BREAKTHROUGH MEANS

Injection Well
Iodide Data

Sample	t	I	delt t	delt	I*delt	Cum. Area
I1	0.12	59.50	0.12	0.54	31.83	31.8325
I2	0.95	62.10	0.83	0.64	39.74	71.57649
I3	1.40	49.76	0.45	0.38	18.66	90.23649
I4	1.70	53.50	0.30	0.63	33.44	123.6739
I5	2.65	60.60	0.95	0.89	53.63	177.3049
I7	3.47	60.50	0.82	1.28	77.14	254.4424
I8	5.20	57.90	1.73	1.44	83.38	337.8184
I9	6.35	59.40	1.15	1.01	59.99	397.8125
I10	7.22	61.12	0.87	0.71	43.40	441.2077
I11	7.77	54.30	0.55	1.39	75.48	516.6846
I13	10.00	56.10	2.23	1.29	72.37	589.0536
I14	10.35	57.70	0.35	0.67	38.37	627.4241
I15	11.33	55.20	0.98	1.41	77.83	705.2561
I16	13.17	65.00	1.84	1.72	111.80	817.0561
I17	14.77	62.40	1.60	1.86	116.38	933.4322
I18	16.90	59.80	2.13	2.31	138.44	1071.869
I20	19.40	70.50	2.50	1.80	126.90	1198.769
I21	20.50	61.20	1.10	1.80	110.16	1308.929
I24	23.00	67.40	2.50	1.90	128.06	1436.989
I26	24.30	80.60	1.30	1.25	100.75	1537.739
I27	25.50	90.00	1.20	1.10	99.00	1636.739
I28	26.50	70.40	1.00	0.85	59.84	1696.579
I29	27.20	69.02	0.70	0.55	37.96	1734.540
I30	27.60	0.85	0.40	0.60	0.51	1735.050
I31	28.40	1.08	0.80	2.10	2.27	1737.318
I34	31.80	2.53	3.40	2.70	6.83	1744.149
I35	33.80	2.78	2.00	3.30	9.18	1753.329
I38	38.40	4.74	4.60	4.45	21.09	1774.422
I42	42.70	6.44	4.30	3.70	23.83	1798.250
I45	45.80	7.41	3.10	2.55	18.90	1817.146
I47	47.80	8.90	2.00	2.05	18.25	1835.391
I49	49.90	10.00	2.10	1.55	15.50	1850.891
I50	50.90	10.50	1.00	1.00	10.50	1861.391
I51	51.90	9.90	1.00	1.10	10.89	1872.281
I52	53.10	10.40	1.20	1.00	10.40	1882.681
I53	53.90	11.19	0.80	0.90	10.07	1892.752
I54	54.90	11.50	1.00	1.00	11.50	1904.252
I55	55.90	11.70	1.00	1.55	18.13	1922.387
I57	58.00	10.90	2.10	2.05	22.34	1944.732
I59	60.00	10.60	2.00	2.15	22.79	1967.522
I61	62.30	10.20	2.30	1.75	17.85	1985.372
I62	63.50	10.20	1.20	1.65	16.83	2002.202
I64	65.60	9.20	2.10	1.95	17.94	2020.142
I66	67.40	8.86	1.80	1.85	16.39	2036.533
I68	69.30	8.38	1.90	2.00	16.76	2053.293
I70	71.40	7.50	2.10	2.00	15.00	2068.293
I72	73.30	7.00	1.90	2.05	14.35	2082.643
I74	75.50	6.70	2.20	2.15	14.40	2097.048
I76	77.60	5.30	2.10	2.05	10.86	2107.913

Injection Well
Iodide Data

Sample	t	I	delt t	delt	I*delt	Cum. Area
I78	79.60	5.85	2.00	2.25	13.16	2121.075
I80	82.10	4.62	2.50	4.40	20.33	2141.403
I83	88.40	3.65	6.30	5.10	18.62	2160.018
I85	92.30	3.61	3.90	3.95	14.26	2174.278
I87	96.30	3.30	4.00	4.00	13.20	2187.478
I89	100.30	3.30	4.00	6.15	20.29	2207.773
I91	108.60	2.46	8.30	8.10	19.93	2227.699
I93	116.50	1.95	7.90	7.85	15.31	2243.006
I95	124.30	1.70	7.80	6.25	10.63	2253.631
I96	129.00	1.40	4.70	6.40	8.96	2262.591
I98	137.10	1.30	8.10	8.05	10.47	2273.056
I100	145.10	1.10	8.00	8.00	8.80	2281.856
I102	153.10	0.94	8.00	6.00	5.64	2287.496
I103	157.10	0.90	4.00	4.05	3.64	2291.141
I104	161.20	0.80	4.10	7.15	5.72	2296.861
I106	171.40	0.70	10.20	13.19	9.23	2306.094
I110	187.58	0.71	16.18	22.61	16.05	2322.144
I117	216.61	0.46	29.03	24.39	11.22	2333.361
I121	236.35	0.38	19.74	12.89	4.90	2338.257
I122	242.38	0.34	6.03	9.02	3.07	2341.326
I123	254.40	0.30	12.02	6.01	1.80	2343.129

Area under Injection: 1734.540 (I1 to I29)
Total time of injection : 27.55
Average Injection : 62.95971

Area under Second Pulse: 608.5890 (I30 to I123)
Peak Concentration: 11.7

COM for 1st pulse: 14.77
1/2 Area: 867.2701

COM for both pulses: 19.56
1/2 Area: 1171.564

Drive Point A
Iodide Data

Sample	t	I	delt t	delt	Area I*delt	Cumulative Area
A2	3.90	0.01	3.90	3.70	0.04	0.04
A3	7.40	0.01	3.50	3.35	0.03	0.07
A5	10.60	0.54	3.20	3.75	2.03	2.10
A7	14.90	7.37	4.30	3.25	23.95	26.05
A8	17.10	11.83	2.20	1.70	20.11	46.16
A9	18.30	13.9	1.20	1.20	16.68	62.84
A10	19.50	21.4	1.20	1.15	24.61	87.45
A11	20.60	19.6	1.10	1.13	22.05	109.50
A12	21.75	21.8	1.15	1.30	28.34	137.84
A13	23.20	25.67	1.45	1.32	34.01	171.85
A14	24.40	27.4	1.20	1.15	31.51	203.36
A15	25.50	32.26	1.10	1.05	33.87	237.23
A16	26.50	38	1.00	1.40	53.20	290.43
A17	28.30	36.96	1.80	1.50	55.44	345.87
A18	29.50	39.9	1.20	1.75	69.83	415.70
A19	31.80	44.6	2.30	2.20	98.12	513.82
A20	33.90	46.6	2.10	3.30	153.78	667.60
A23	38.40	49.8	4.50	4.10	204.18	871.78
A26	42.10	51.7	3.70	2.25	116.33	988.10
A27	42.90	45.8	0.80	1.05	48.09	1036.19
A28	44.20	50.5	1.30	1.65	83.33	1119.52
A30	46.20	46.8	2.00	1.50	70.20	1189.72
A31	47.20	47.3	1.00	1.05	49.66	1239.38
A32	48.30	44.6	1.10	1.05	46.83	1286.21
A33	49.30	45.3	1.00	1.00	45.30	1331.51
A34	50.30	42.5	1.00	1.05	44.63	1376.14
A35	51.40	40.7	1.10	1.10	44.77	1420.91
A36	52.50	36.6	1.10	1.60	58.56	1479.47
A38	54.60	36.93	2.10	1.45	53.55	1533.02
A39	55.40	34.34	0.80	1.10	37.77	1570.79
A40	56.80	26.4	1.40	1.10	29.04	1599.83
A41	57.60	23.6	0.80	0.90	21.24	1621.07
A42	58.60	24.2	1.00	1.05	25.41	1646.48
A43	59.70	21.15	1.10	1.60	33.84	1680.32
A45	61.80	16.6	2.10	1.55	25.73	1706.05
A46	62.80	15.6	1.00	1.05	16.38	1722.43
A47	63.90	14.2	1.10	1.00	14.20	1736.63
A48	64.80	12.9	0.90	0.90	11.61	1748.24
A49	65.70	10.9	0.90	1.00	10.90	1759.14
A50	66.80	11.7	1.10	0.97	11.35	1770.49
A51	67.64	11.2	0.84	0.95	10.64	1781.13
A52	68.70	11	1.06	1.03	11.33	1792.46
A53	69.70	10.9	1.00	1.10	11.99	1804.45
A54	70.90	10.9	1.20	1.10	11.99	1816.44
A55	71.90	9.1	1.00	1.00	9.10	1825.54
A56	72.90	10.5	1.00	1.00	10.50	1836.04

Drive Point A
Iodide Data

Sample	t	I	delt t	delt	Area I*delt	Cumulative Area
A57	73.90	10.3	1.00	1.10	11.33	1847.37
A58	75.10	10.2	1.20	1.30	13.26	1860.63
A59	76.50	9.1	1.40	1.10	10.01	1870.64
A60	77.30	9.1	0.80	1.00	9.10	1879.74
A61	78.50	10.6	1.20	1.05	11.13	1890.87
A62	79.40	10.3	0.90	0.95	9.79	1900.66
A63	80.40	10.6	1.00	2.60	27.56	1928.22
A65	84.60	9	4.20	3.95	35.55	1963.77
A67	88.30	9.1	3.70	3.90	35.49	1999.26
A69	92.40	9.1	4.10	4.10	37.31	2036.57
A71	96.50	8.28	4.10	4.10	33.95	2070.51
A73	100.60	7.7	4.10	4.15	31.96	2102.47
A74	104.80	6.8	4.20	3.95	26.86	2129.33
A75	108.50	5.5	3.70	3.95	21.72	2151.05
A76	112.70	4.7	4.20	4.20	19.74	2170.79
A77	116.90	3.99	4.20	3.80	15.16	2185.96
A78	120.30	3.83	3.40	3.70	14.17	2200.13
A79	124.30	3.4	4.00	4.40	14.96	2215.09
A80	129.10	2.8	4.80	4.35	12.18	2227.27
A81	133.00	2.3	3.90	4.05	9.31	2236.58
A82	137.20	2.3	4.20	3.95	9.08	2245.67
A83	140.90	2.1	3.70	3.70	7.77	2253.44
A84	144.60	2.1	3.70	3.90	8.19	2261.63
A85	148.70	1.8	4.10	4.05	7.29	2268.92
A86	152.70	1.6	4.00	4.00	6.40	2275.32
A87	156.70	1.7	4.00	4.00	6.80	2282.12
A88	160.70	1.6	4.00	7.40	11.84	2293.96
A90	171.50	1.2	10.80	9.55	11.46	2305.42
A92	179.80	1.1	8.30	7.95	8.74	2314.16
A94	187.40	0.95	7.60	9.78	9.29	2323.45
A97	199.36	0.77	11.96	10.53	8.10	2331.56
A99	208.45	0.67	9.09	8.68	5.81	2337.37
A101	216.71	0.62	8.26	7.89	4.89	2342.26
A103	224.23	0.6	7.52	9.93	5.96	2348.22
A105	236.58	0.49	12.35	9.15	4.48	2352.71
A106	242.53	0.41	5.95	8.99	3.69	2356.39
A107	254.56	0.36	12.03	23.91	8.61	2365.00
A110	290.35	0.1	35.79	43.89	4.39	2369.39
A114	342.33	0.07	51.98	25.99	1.82	2371.21

Total Area under both peaks: 2371.207
COM for both peaks: 46.61
1/2 Area: 1185.603

Area under Iodide front (A2 to A26): 988.1047
COM for I front: 32.41
1/2 Area: 494.0523

Drive Point A
TCE Data

Sample	t	TCE	delt t	delt	Area TCE*delt	Cumulative Area
A1	1.37	44.513	1.37	4.385	195.1895	195.19
A3	7.40	40.79	6.03	4.615	188.2458	383.44
A5	10.6	42.5	3.2	2.575	109.4375	492.87
A6	12.55	40.886	1.95	3.25	132.8795	625.75
A8	17.1	36.03	4.55	4.025	145.0207	770.77
A11	20.60	33.009	3.5	3.65	120.4828	891.26
A14	24.4	25.194	3.8	3.85	96.9969	988.25
A17	28.30	18.89	3.9	2.55	48.1695	1036.42
A18	29.50	16.791	1.2	2.8	47.0148	1083.44
A20	33.90	9.799	4.4	3.8	37.2362	1120.67
A22	37.1	10.044	3.2	2.85	28.6254	1149.30
A24	39.60	7.993	2.5	3.55	28.37515	1177.67
A28	44.2	5.4	4.6	3.3	17.82	1195.49
A30	46.2	4.597	2	2.05	9.42385	1204.92
A32	48.3	4.771	2.1	2.05	9.78055	1214.70
A34	50.30	3.867	2	2.1	8.1207	1222.82
A36	52.50	4.224	2.2	2.15	9.0816	1231.90
A38	54.60	4.093	2.1	2.15	8.79995	1240.70
A40	56.80	3.995	2.2	2	7.99	1248.69
A42	58.6	3.06	1.8	2.065	6.3189	1255.01
A44	60.93	3.022	2.33	2.1	6.3462	1261.36
A46	62.80	2.988	1.87	1.935	5.78178	1267.14
A48	64.80	2.918	2	2.42	7.06156	1274.20
A51	67.64	2.54	2.84	3.05	7.747	1281.95
A54	70.90	3.1	3.26	2.63	8.153	1290.10
A56	72.90	2.559	2	2	5.118	1295.22

Area under desorption curve: 1295.216
Maximum Concentration: 44.51 ppb
Equivalent pulse-mean = 1295.22/44.51 = 29.10 hr

Drive Point A
TCA Data

Sample	t	TCA	delt t	delt	Area TCA*delt	Cumulative Area
A1	1.37	37.306	1.37	4.385	163.59	163.59
A3	7.40	34.134	6.03	4.615	157.53	321.12
A5	10.6	35.494	3.2	2.575	91.40	412.51
A6	12.55	32.801	1.95	3.25	106.60	519.12
A8	17.1	28.557	4.55	4.025	114.94	634.06
A11	20.60	24.727	3.5	3.65	90.25	724.31
A14	24.4	17.879	3.8	3.85	68.83	793.15
A17	28.30	13.585	3.9	2.55	34.64	827.79
A18	29.50	11.768	1.2	2.8	32.95	860.74
A20	33.90	6.494	4.4	3.8	24.68	885.41
A22	37.1	6.614	3.2	2.85	18.85	904.26
A24	39.60	5.324	2.5	3.55	18.90	923.16
A28	44.2	3.835	4.6	3.3	12.66	935.82
A30	46.2	3.261	2	2.05	6.69	942.51
A32	48.3	3.324	2.1	2.05	6.81	949.32
A34	50.30	2.487	2	2.1	5.22	954.54
A36	52.50	2.776	2.2	2.15	5.97	960.51
A38	54.60	2.51	2.1	2.15	5.40	965.91
A40	56.80	2.465	2.2	2	4.93	970.84
A42	58.6	1.887	1.8	2.065	3.90	974.73
A44	60.93	1.814	2.33	2.1	3.81	978.54
A46	62.80	1.806	1.87	1.935	3.49	982.04
A48	64.80	1.799	2	2.42	4.35	986.39
A51	67.64	1.463	2.84	3.05	4.46	990.85
A54	70.90	1.789	3.26	2.63	4.71	995.56
A56	72.90	1.416	2	2	2.83	998.39

Area under desorption curve: 998.3904
Maximum Concentration: 37.31 ppb
Equivalent pulse-mean= 998.39/37.31 = 26.76 hr

Drive Point C
Iodide Data

Sample	t	I	delt t	delt	Area I*delt	Cumulative Area
C2	4.15	0.02	4.15	5.45	0.11	0.1090
C5	10.90	0.01	6.75	5.68	0.06	0.1658
C7	15.50	0.04	4.60	3.80	0.15	0.3178
C8	18.50	0.01	3.00	4.35	0.04	0.3613
C10	24.20	0.01	5.70	6.75	0.07	0.4288
C13	32.00	0.01	7.80	10.20	0.10	0.5307
C17	44.60	0.01	12.60	12.30	0.12	0.6537
C23	56.60	0.03	12.00	11.40	0.34	0.9958
C28	67.40	0.02	10.80	6.45	0.13	1.1248
C29	69.50	0.02	2.10	5.20	0.10	1.2288
C33	77.80	0.02	8.30	8.85	0.18	1.4058
C36	87.20	0.01	9.40	8.75	0.09	1.4933
C38	95.30	0.04	8.10	8.20	0.33	1.8213
C40	103.60	0.08	8.30	10.10	0.81	2.6292
C43	115.50	0.24	11.90	8.60	2.06	4.6933
C45	120.80	0.62	5.30	4.75	2.95	7.6383
C46	125.00	1.22	4.20	4.25	5.19	12.8233
C47	129.30	1.64	4.30	4.15	6.81	19.6293
C48	133.30	2	4.00	4.05	8.10	27.7292
C49	137.40	2.3	4.10	3.95	9.08	36.8142
C50	141.20	2.7	3.80	3.75	10.13	46.9392
C51	144.90	3.2	3.70	3.85	12.32	59.2592
C52	148.90	3.96	4.00	4.05	16.04	75.2972
C53	153.00	4.8	4.10	4.00	19.20	94.4972
C54	156.90	4.9	3.90	4.00	19.60	114.0972
C55	161.00	5.3	4.10	4.55	24.12	138.2123
C56	166.00	5.24	5.00	4.50	23.58	161.7923
C57	170.00	5.6	4.00	2.90	16.24	178.0323
C58	171.80	5.8	1.80	5.05	29.29	207.3223
C60	180.10	5.7	8.30	8.00	45.60	252.9223
C62	187.80	5.38	7.70	7.60	40.89	293.8103
C64	195.30	4.3	7.50	5.88	25.26	319.0728
C65	199.55	4.51	4.25	6.65	29.99	349.0643
C67	208.60	3.89	9.05	8.63	33.55	382.6155
C69	216.80	3.3	8.20	7.93	26.17	408.7845
C71	224.46	2.88	7.66	10.00	28.80	437.5845
C73	236.80	2.38	12.34	9.17	21.82	459.4091
C74	242.80	1.96	6.00	5.75	11.27	470.6791
C75	248.30	1.82	5.50	6.00	10.92	481.5991
C76	254.80	1.66	6.50	6.40	10.62	492.2231
C77	261.10	1.62	6.30	5.94	9.62	501.8459
C78	266.68	1.57	5.58	11.76	18.47	520.3170
C81	284.63	1.21	17.95	29.91	36.19	556.5081
C88	326.50	1.28	41.87	28.96	37.08	593.5833
C90	342.56	0.47	16.06	30.91	14.53	608.1133

Drive Point C
Iodide Data

Sample	t	I	delt t	delt	Area I*delt	Cumulative Area
C92	388.33	0.19	45.77	44.85	8.52	616.6339
C94	432.25	0.12	43.92	56.97	6.84	623.4697
C96	502.26	0.16	70.01	87.90	14.06	637.5345
C98	608.06	0.09	105.80	99.60	8.96	646.4980
C100	701.45	0.07	93.39	93.39	6.54	653.0353

Total Area: 653.0353
COM: 199.08
1/2 Area: 326.5176

Drive Point C
TCE Data

Sample	t	TCE	delt t	delt	Area TCE*delt	Cumulative Area
C1	2.1	25.99	2.10	4.37	113.45	
C3	6.63	27.85	4.53	5.70	158.75	
C6	13.5	26.59	6.87	5.94	157.81	
C8	18.50	27.22	5.00	5.35	145.63	
C10	24.20	29.59	5.70	6.75	199.73	
C13	32.00	29.36	7.80	6.56	192.75	
C14	37.33	27.32	5.33	5.13	140.02	
C16	42.25	28.76	4.92	5.63	161.78	
C19	48.58	29.51	6.33	5.39	159.06	
C21	53.03	29.31	4.45	4.01	117.53	
C23	56.60	30.07	3.57	4.06	122.23	
C25	61.16	32.39	4.56	4.45	144.14	
C27	65.5	29.08	4.34	4.17	121.26	
C29	69.50	30.38	4.00	4.03	122.43	
C31	73.56	28.89	4.06	4.15	119.89	
C33	77.80	31.44	4.24	4.98	156.73	
C35	83.53	31.1	5.73	6.70	208.37	
C37	91.2	32.06	7.67	7.98	255.68	
C39	99.48	31.96	8.28	8.13	259.68	
C41	107.45	33.26	7.97	8.01	266.41	
C43	115.50	34.21	8.05	6.68	228.35	228.3518
C45	120.80	33.48	5.30	6.90	231.01	459.3638
C47	129.30	31.74	8.50	8.30	263.44	722.8057
C49	137.40	30.33	8.10	7.80	236.57	959.3795
C51	144.90	28.66	7.50	7.80	223.55	1182.927
C53	153.00	24.65	8.10	8.05	198.43	1381.360
C55	161.00	20.8	8.00	13.55	281.84	1663.200
C60	180.10	13.57	19.10	13.40	181.84	1845.038
C62	187.8	10.42	7.70	7.60	79.19	1924.230
C64	195.30	7.89	7.50	8.41	66.39	1990.624
C66	204.63	7.64	9.33	8.72	66.66	2057.283
C68	212.75	6.64	8.12	8.09	53.68	2110.968
C70	220.8	5.64	8.05	8.90	50.20	2161.164
C72	230.55	4.96	9.75	11.00	54.56	2215.724
C74	242.80	4.25	12.25	12.13	51.53	2267.255
C76	254.80	3.61	12.00	11.94	43.10	2310.358
C78	266.68	3.08	11.88	12.04	37.08	2347.441
C80	278.88	2.71	12.20	11.95	32.38	2379.826
C82	290.58	2.43	11.70	11.81	28.71	2408.536
C84	302.51	2.49	11.93	12.81	31.91	2440.446
C86	316.21	3.56	13.70	20.03	71.29	2511.735
C90	342.56	2.19	26.35	45.06	98.68	2610.416
C93	406.33	1.39	63.77	79.85	110.99	2721.408
C96	502.26	1.62	95.93	64.66	104.75	2826.157
C97	535.65	2.04	33.39	52.90	107.92	2934.073

Drive Point C
TCE Data

Sample	t	TCE	delt t	delt	Area TCE*delt	Cumulative Area
C98	608.06	1.181	72.41	47.38	55.95	2990.023
C99	630.4	1.36	22.34	22.30	30.33	3020.351
C99(MISL)	652.66	1.103	22.26	22.26	24.55	3044.903

Average Co for TCE (Cmax): 30.06066 (C1 to C43)
Time averaged over: 118.15

Desorption starts at: 111.475
Total area under desorption curve: 3044.903

Equivalent pulse-mean = 111.48 + (3044.90/30.06) = 212.77 hr

Drive Point C
TCA Data

Sample	t	TCA	delt t	delt	Area TCA*delt	Cumulative Area
C1	2.1	30.74	2.10	4.37	134.18	
C3	6.63	33.08	4.53	5.70	188.56	
C6	13.5	31.33	6.87	5.94	185.94	
C8	18.50	32.18	5.00	5.35	172.16	
C10	24.20	34.69	5.70	6.75	234.16	
C13	32.00	34.46	7.80	6.56	226.23	
C14	37.33	30.62	5.33	5.13	156.93	
C16	42.25	32.73	4.92	5.63	184.11	
C19	48.58	33.82	6.33	5.39	182.29	
C21	53.03	32.81	4.45	4.01	131.57	
C23	56.60	34.26	3.57	4.06	139.27	
C25	61.16	35.95	4.56	4.45	159.98	
C27	65.5	32.42	4.34	4.17	135.19	
C29	69.50	33.58	4.00	4.03	135.33	
C31	73.56	31.39	4.06	4.15	130.27	
C33	77.80	34.19	4.24	4.98	170.44	
C35	83.53	33.41	5.73	6.70	223.85	
C37	91.2	33.56	7.67	7.98	267.64	
C39	99.48	33.34	8.28	8.13	270.89	
C41	107.45	33.88	7.97	8.01	271.38	
C43	115.50	34.92	8.05	6.68	233.09	233.09
C45	120.80	34.07	5.30	6.90	235.08	468.17
C47	129.30	32.81	8.50	8.30	272.32	740.50
C49	137.40	30.80	8.10	7.80	240.24	980.74
C51	144.90	29.39	7.50	7.80	229.24	1209.98
C53	153.00	25.06	8.10	8.05	201.73	1411.71
C55	161.00	21.40	8.00	13.55	289.97	1701.68
C60	180.10	13.68	19.10	13.40	183.31	1884.99
C62	187.8	10.62	7.70	7.60	80.71	1965.71
C64	195.30	7.73	7.50	8.41	65.05	2030.75
C66	204.63	7.45	9.33	8.72	65.00	2095.76
C68	212.75	6.43	8.12	8.09	51.99	2147.74
C70	220.8	5.36	8.05	8.90	47.70	2195.45
C72	230.55	4.76	9.75	11.00	52.36	2247.81
C74	242.80	3.96	12.25	12.13	48.02	2295.82
C76	254.80	3.34	12.00	11.94	39.88	2335.70
C78	266.68	2.75	11.88	12.04	33.11	2368.81
C80	278.88	2.44	12.20	11.95	29.16	2397.97
C82	290.58	2.01	11.70	11.81	23.75	2421.72
C84	302.51	2.1	11.93	12.81	26.91	2448.63
C86	316.21	3.23	13.70	20.03	64.68	2513.31
C90	342.56	1.81	26.35	45.06	81.56	2594.87
C93	406.33	1.07	63.77	79.85	85.44	2680.31
C96	502.26	1.36	95.93	64.66	87.94	2768.24
C97	535.65	1.82	33.39	52.90	96.28	2864.52

Drive Point C
TCA Data

Sample	t	TCA	delt t	delt	Area TCA*delt	Cumulative Area
C98	608.06	1.091	72.41	47.38	51.69	2916.21
C99	630.4	0.89	22.34	22.30	19.85	2936.06
C99(MISL)	652.66	0.98	22.26	22.26	21.70	2957.76

Average Co for TCA (Cmax): 33.29188 (C1 to C43)
Time averaged over: 118.15

Desorption starts at: 111.475
Total area under desorption curve: 2957.759

Equivalent pulse-mean = 111.48 + (2957.76/33.29) = 200.33 hr

Drive Point D Iodide Data Sample	t	I	delt t	delt	Area I*delt	Cumulative Area
D2	4.30	0.41	4.30	3.35	1.37	1.37
D3	6.70	0.34	2.40	2.30	0.78	2.16
D4	8.90	0.33	2.20	2.15	0.71	2.87
D5	11.00	0.3	2.10	3.40	1.02	3.89
D7	15.70	0.33	4.70	4.30	1.42	5.30
D10	19.60	0.34	3.90	3.20	1.09	6.39
D12	22.10	0.3	2.50	2.50	0.75	7.14
D14	24.60	0.3	2.50	2.30	0.69	7.83
D16	26.70	0.29	2.10	2.50	0.73	8.56
D17	29.60	0.28	2.90	2.80	0.78	9.34
D18	32.30	0.28	2.70	2.30	0.64	9.99
D19	34.20	0.31	1.90	5.00	1.55	11.54
D22	42.30	0.24	8.10	5.25	1.26	12.80
D23	44.70	0.21	2.40	4.20	0.88	13.68
D26	50.70	0.22	6.00	9.40	2.07	15.75
D32	63.50	0.26	12.80	8.40	2.18	17.93
D34	67.50	0.42	4.00	3.05	1.28	19.21
D35	69.60	0.6	2.10	5.25	3.15	22.36
D39	78.00	1.6	8.40	7.10	11.36	33.72
D41	83.80	3.2	5.80	4.90	15.68	49.40
D43	87.80	4.06	4.00	4.05	16.44	65.84
D45	91.90	5.44	4.10	4.10	22.30	88.15
D47	96.00	6.3	4.10	3.05	19.21	107.36
D48	98.00	5.97	2.00	3.90	23.28	130.65
D50	103.80	6.7	5.80	4.80	32.16	162.80
D51	107.60	5.9	3.80	3.90	23.01	185.81
D52	111.60	5.9	4.00	4.00	23.60	209.41
D53	115.60	5.7	4.00	3.50	19.95	229.36
D54	118.60	6.5	3.00	2.95	19.18	248.54
D55	121.50	3.9	2.90	3.40	13.26	261.80
D56	125.40	6.8	3.90	4.00	27.20	289.00
D57	129.50	5.53	4.10	3.95	21.84	310.84
D58	133.30	5.2	3.80	4.00	20.80	331.64
D59	137.50	4.8	4.20	4.00	19.20	350.84
D60	141.30	4.7	3.80	3.75	17.63	368.47
D61	145.00	4.6	3.70	3.85	17.71	386.18
D62	149.00	4.1	4.00	4.05	16.61	402.78
D63	153.10	3.8	4.10	4.05	15.39	418.17
D64	157.10	4.3	4.00	4.00	17.20	435.37
D65	161.10	4.1	4.00	4.50	18.45	453.82
D66	166.10	3.7	5.00	4.50	16.65	470.47
D67	170.10	3.1	4.00	2.90	8.99	479.46
D68	171.90	3	1.80	5.05	15.15	494.61
D70	180.20	2.92	8.30	8.05	23.51	518.12
D72	188.00	2.76	7.80	7.60	20.98	539.10
D74	195.40	2	7.40	10.40	20.80	559.90
D77	208.80	1.97	13.40	10.81	21.29	581.18
D79	217.01	1.8	8.21	7.76	13.98	595.16

Drive Point D
Iodide Data

Sample	t	I	delt t	delt	Area I*delt	Cumulative Area
D81	224.33	1.67	7.32	9.91	16.55	611.71
D83	236.83	1.5	12.50	9.28	13.91	625.62
D84	242.88	1.32	6.05	5.75	7.59	633.21
D85	248.33	1.15	5.45	6.01	6.92	640.13
D86	254.91	1.21	6.58	6.45	7.80	647.93
D87	261.23	1.2	6.32	14.92	17.90	665.84
D91	284.75	1.01	23.52	23.63	23.87	689.71
D95	308.5	0.49	23.75	20.79	10.19	699.89
D98	326.33	1.08	17.83	24.81	26.80	726.69
D101	358.13	0.29	31.80	40.00	11.60	738.29
D103	406.33	0.34	48.20	37.12	12.62	750.91
D104	432.36	0.31	26.03	26.03	8.07	758.98

Total Area: 758.9833
1/2 Area: 379.4916
COM: 145.55

Drive Point D
TCE Data

Sample	t	TCE	delt t	delt	Area TCE*delt	Cumulative Area
D1	2.18	17.02	2.18	4.44	75.57	
D3	6.70	15.41	4.52	4.41	67.96	
D5	11	16.21	4.30	4.50	72.95	
D7	15.7	15.47	4.70	4.30	66.52	
D10	19.60	14.28	3.90	3.20	45.70	
D12	22.10	15.26	2.50	3.55	54.17	
D16	26.70	16.05	4.60	6.05	97.10	
D19	34.20	15.08	7.50	7.80	117.62	
D22	42.30	16.16	8.10	7.27	117.56	
D25	48.75	17.1	6.45	7.29	124.66	
D29	56.88	17.11	8.13	7.38	126.19	126.19
D32	63.50	15.81	6.62	6.36	100.55	226.74
D35	69.60	14.58	6.10	6.23	90.76	317.50
D38	75.95	15.3	6.35	7.63	116.66	434.16
D42	84.85	14.47	8.90	6.93	100.28	534.44
D44	89.81	12.02	4.96	4.58	55.05	589.49
D46	94.01	13.85	4.20	4.09	56.72	646.21
D48	98.00	12.99	3.99	4.90	63.59	709.79
D50	103.80	13.74	5.80	6.80	93.43	803.22
D52	111.60	13.46	7.80	7.40	99.60	902.83
D54	118.60	13.30	7.00	6.90	91.77	994.60
D56	125.40	13.71	6.80	7.35	100.77	1095.37
D58	133.30	13.29	7.90	7.95	105.66	1201.02
D60	141.30	11.85	8.00	7.85	93.02	1294.04
D62	149.00	9.86	7.70	7.90	77.89	1371.94
D64	157.10	10.11	8.10	8.55	86.44	1458.38
D66	166.10	9.30	9.00	7.40	68.82	1527.20
D68	171.90	9.26	5.80	7.05	65.28	1592.48
D70	180.20	9.66	8.30	8.05	77.76	1670.24
D72	188	7.69	7.80	7.60	58.44	1728.69
D74	195.40	7.78	7.40	8.36	65.00	1793.69
D76	204.71	7.46	9.31	8.73	65.09	1858.78
D78	212.85	7.26	8.14	8.09	58.77	1917.55
D80	220.9	6.85	8.05	8.89	60.90	1978.44
D82	230.63	6.17	9.73	10.99	67.81	2046.25
D84	242.88	5.87	12.25	12.14	71.26	2117.52
D86	254.91	5.99	12.03	11.95	71.58	2189.10
D88	266.78	5.03	11.87	12.03	60.54	2249.63
D90	278.98	4.6	12.20	11.97	55.04	2304.67
D92	290.71	4.17	11.73	11.81	49.25	2353.92
D94	302.6	4	11.89	15.08	60.30	2414.22
D97	320.86	3.89	18.26	15.03	58.47	2472.69
D99	332.66	4.39	11.80	18.63	81.81	2554.49
D101	358.13	3.79	25.47	36.83	139.60	2694.10

Drive Point D
TCE Data

Sample	t	TCE	delt t	delt	Area TCE*delt	Cumulative Area
D103	406.33	3.02	48.20	125.01	377.55	3071.64
D108	608.16	0.419	201.83	123.21	51.62	3123.27
D110	652.75	0.17	44.59	44.59	7.45	3130.71

Average Co for TCA (Cmax): 16.04913 (D1 to D29)
Time averaged over: 60.19

Desorption curve starts at: 52.815
Total area under desorption curve: 3130.714

Equivalent pulse-mean = 52.82 + (3130.71/16.05) = 247.88 hr

Drive Point D
TCA Data

Sample	t	TCA	delt t	delt	Area TCA*delt	Cumulative Area
D1	2.18	26.01	2.18	4.44	115.48	
D3	6.70	23.67	4.52	4.41	104.38	
D5	11	25.22	4.30	4.50	113.49	
D7	15.7	23.76	4.70	4.30	102.17	
D10	19.60	22.09	3.90	3.20	70.69	
D12	22.10	22.94	2.50	3.55	81.44	
D16	26.70	24.58	4.60	6.05	148.71	
D19	34.20	23.35	7.50	7.80	182.13	
D22	42.30	25.20	8.10	7.27	183.33	
D25	48.75	26.35	6.45	7.29	192.09	
D29	56.88	26.6	8.13	7.38	196.18	196.18
D32	63.50	25.02	6.62	6.36	159.13	355.30
D35	69.60	23.27	6.10	6.23	144.86	500.16
D38	75.95	23.2	6.35	7.63	176.90	677.06
D42	84.85	23.02	8.90	6.93	159.53	836.59
D44	89.81	18.56	4.96	4.58	85.00	921.59
D46	94.01	21.55	4.20	4.09	88.25	1009.84
D48	98.00	20.62	3.99	4.90	100.93	1110.77
D50	103.80	22.72	5.80	6.80	154.50	1265.27
D52	111.60	21.01	7.80	7.40	155.47	1420.74
D54	118.60	20.95	7.00	6.90	144.56	1565.30
D56	125.40	20.95	6.80	7.35	153.98	1719.28
D58	133.30	20.73	7.90	7.95	164.80	1884.08
D60	141.30	18.17	8.00	7.85	142.63	2026.72
D62	149.00	15.31	7.70	7.90	120.95	2147.67
D64	157.10	15.24	8.10	8.55	130.30	2277.97
D66	166.10	14.08	9.00	7.40	104.19	2382.16
D68	171.90	14.01	5.80	7.05	98.77	2480.93
D70	180.20	14.57	8.30	8.05	117.29	2598.22
D72	188	11.51	7.80	7.60	87.48	2685.70
D74	195.40	11.74	7.40	8.36	98.09	2783.78
D76	204.71	10.91	9.31	8.73	95.19	2878.97
D78	212.85	10.43	8.14	8.09	84.43	2963.41
D80	220.9	10.01	8.05	8.89	88.99	3052.39
D82	230.63	8.82	9.73	10.99	96.93	3149.33
D84	242.88	8.36	12.25	12.14	101.49	3250.82
D86	254.91	8.50	12.03	11.95	101.57	3352.39
D88	266.78	7.34	11.87	12.03	88.34	3440.73
D90	278.98	6.53	12.20	11.97	78.13	3518.86
D92	290.71	5.76	11.73	11.81	68.03	3586.89
D94	302.6	5.48	11.89	15.08	82.61	3669.50
D97	320.86	5.34	18.26	15.03	80.26	3749.76
D99	332.66	6.13	11.80	18.63	114.23	3863.99
D101	358.13	5.2	25.47	36.83	191.54	4055.53

Drive Point D
TCA Data

Sample	t	TCA	delt t	delt	Area TCA*delt	Cumulative Area
D103	406.33	4.14	48.20	125.01	517.56	4573.09
D108	608.16	0.772	201.83	123.21	95.12	4668.21
D110	652.75	0.37	44.59	44.59	16.28	4684.49

Average Co for TCA (Cmax): 24.75639 (D1 to D29)
Time averaged over: 60.19

Desorption curve starts at: 52.815
Total area under desorption curve: 4684.486

Equivalent pulse-mean = 52.82 + (4684.49/24.76) = 242.02 hr

Fully Penetrating Monitoring Well
Iodide Data

Sample	t	I	delt t	delt	Area I*delt	Cumulative Area
M1	6.23	0.01	6.23	1.17	0.01	0.01
M3	7.40	0.31	1.17	1.73	0.54	0.55
M4	9.70	1.71	2.30	2.15	3.68	4.23
M5	11.70	4.90	2.00	1.80	8.82	13.05
M6	13.30	7.30	1.60	1.55	11.32	24.36
M7	14.80	11.80	1.50	1.83	21.54	45.90
M8	16.95	20.03	2.15	1.67	33.55	79.45
M9	18.15	23.10	1.20	1.17	27.14	106.59
M10	19.30	25.20	1.15	1.13	28.35	134.94
M11	20.4	28.8	1.10	1.15	33.12	168.06
M12	21.60	32.30	1.20	1.65	53.30	221.35
M13	23.70	35.50	2.10	1.90	67.45	288.80
M14	25.40	36.60	1.70	1.50	54.90	343.70
M15	26.70	32.60	1.30	1.70	55.42	399.12
M16	28.80	35.60	2.10	2.47	88.11	487.23
M17	31.65	38.20	2.85	2.20	84.04	571.27
M18	33.20	46.60	1.55	1.88	87.38	658.65
M19	35.40	48.90	2.20	2.80	136.92	795.57
M21	38.80	33.05	3.40	2.45	80.97	876.54
M22	40.30	41.70	1.50	1.60	66.72	943.26
M23	42.00	32.80	1.70	1.60	52.48	995.74
M24	43.50	29.60	1.50	1.55	45.88	1041.62
M25	45.10	18.90	1.60	1.35	25.52	1067.14
M26	46.20	22.20	1.10	1.20	26.64	1093.78
M27	47.50	18.10	1.30	1.40	25.34	1119.12
M28	49.00	17.52	1.50	1.35	23.65	1142.77
M29	50.20	15.76	1.20	1.20	18.91	1161.68
M30	51.40	16.30	1.20	1.25	20.37	1182.06
M31	52.70	14.40	1.30	1.35	19.44	1201.50
M32	54.10	15.55	1.40	1.30	20.21	1221.71
M33	55.30	15.68	1.20	1.05	16.46	1238.17
M34	56.20	14.57	0.90	1.10	16.03	1254.20
M35	57.50	13.90	1.30	1.10	15.29	1269.49
M36	58.40	11.49	0.90	1.10	12.64	1282.13
M37	59.70	11.90	1.30	1.20	14.28	1296.41
M38	60.80	10.20	1.10	1.05	10.71	1307.12
M39	61.80	10.10	1.00	1.10	11.11	1318.23
M40	63.00	9.20	1.20	1.10	10.12	1328.35
M41	64.00	10.70	1.00	1.00	10.70	1339.05
M42	65.00	10.50	1.00	1.10	11.55	1350.60
M43	66.20	8.80	1.20	1.05	9.24	1359.84
M44	67.10	9.70	0.90	0.85	8.25	1368.09
M45	67.9	8.8	0.80	0.95	8.36	1376.45
M46	69.00	9.70	1.10	1.25	12.13	1388.57
M47	70.40	8.80	1.40	1.40	12.32	1400.89
M48	71.80	8.90	1.40	3.45	30.71	1431.60

Fully Penetrating Monitoring Well
Iodide Data

Sample	t	I	delt t	delt	Area I*delt	Cumulative Area
M49	77.30	9.20	5.50	3.60	33.12	1464.72
M50	79.00	10.30	1.70	1.60	16.48	1481.20
M51	80.50	9.80	1.50	1.35	13.23	1494.43
M52	81.70	9.50	1.20	3.15	29.93	1524.35
M54	86.80	6.61	5.10	5.15	34.04	1558.39
M56	92.00	6.20	5.20	4.95	30.69	1589.08
M58	96.70	5.94	4.70	6.30	37.42	1626.50
M60	104.60	4.90	7.90	10.05	49.25	1675.75
M63	116.80	3.20	12.20	10.45	33.44	1709.19
M65	125.50	2.40	8.70	6.40	15.36	1724.55
M66	129.60	2.10	4.10	6.05	12.71	1737.25
M68	137.60	1.70	8.00	7.85	13.34	1750.60
M70	145.30	1.30	7.70	7.85	10.20	1760.80
M72	153.30	1.10	8.00	6.00	6.60	1767.40
M73	157.30	1.20	4.00	3.85	4.62	1772.02
M74	161.00	1.10	3.70	7.25	7.98	1780.00
M76	171.80	0.80	10.80	9.40	7.52	1787.52
M78	179.80	0.81	8.00	7.93	6.42	1793.94
M80	187.66	0.71	7.86	9.94	7.06	1801.00
M83	199.68	0.59	12.02	12.42	7.33	1808.33
M86	212.51	0.51	12.83	12.36	6.30	1814.63
M89	224.40	0.42	11.89	12.02	5.05	1819.68
M91	236.55	0.38	12.15	9.09	3.45	1823.14
M92	242.58	0.31	6.03	9.03	2.80	1825.93
M93	254.60	0.27	12.02	12.02	3.25	1829.18

Area under peaks: 1829.179
1/2 Area: 914.5897
COM of peaks: 40.46

Area under iodide front: 795.5688
1/2 Area: 397.7844
COM of iodide front: 27.71

Fully Penetrating Monitoring Well

TCE Data Sample	t	TCE	delt	t delt	Area TCE*delt	Cumulative Area
M3	7.40	40.25	7.40	10.35	416.63	416.63
M6	13.30	36.06	5.90	4.78	172.18	588.81
M8	16.95	29.76	3.65	3.55	105.65	694.46
M11	20.4	24.519	3.45	3.38	82.75	777.21
M13	23.70	20.21	3.30	5.63	113.66	890.87
M17	31.65	16.86	7.95	5.85	98.60	989.47
M19	35.40	12.55	3.75	4.32	54.27	1043.74
M22	40.30	9.49	4.90	4.05	38.44	1082.18
M24	43.50	11.69	3.20	2.95	34.50	1116.68
M26	46.20	13.18	2.70	4.60	60.64	1177.32
M31	52.70	13.53	6.50	4.55	61.58	1238.89
M33	55.30	10.27	2.60	3.50	35.95	1274.84
M37	59.70	12.54	4.40	4.35	54.53	1329.37
M41	64.00	11.30	4.30	3.25	36.72	1366.09
M43	66.20	12.86	2.20	1.95	25.07	1391.17
M45	67.9	11.898	1.70	2.10	24.99	1416.15
M47	70.40	10.30	2.50	4.70	48.40	1464.55
M49	77.30	9.04	6.90	5.05	45.65	1510.20
M51	80.50	6.55	3.20	3.35	21.94	1532.14
M53	84	5.35	3.50	4.30	23.00	1555.14
M55	89.1	9.849	5.10	5.33	52.50	1607.64
M57	94.66	7.939	5.56	5.12	40.61	1648.25
M59	99.33	7.613	4.67	6.81	51.84	1700.09
M61	108.28	7.084	8.95	8.74	61.88	1761.97
M63	116.80	5.43	8.52	8.52	46.29	1808.26

Area under desorption curve: 1808.258
Initial concentration (Cmax): 40.25 ppb

Equivalent pulse-mean = 1808.26/40.25 = 44.93 hr

Fully Penetrating Monitoring Well

TCA Data Sample	t	TCA	delt t	delt	Area TCA*delt	Cumulative Area
M3	7.40	30.68	7.40	10.35	317.53	317.53
M6	13.30	28.47	5.90	4.78	135.93	453.46
M8	16.95	23.10	3.65	3.55	82.00	535.46
M11	20.4	19.38	3.45	3.38	65.40	600.86
M13	23.70	16.03	3.30	5.63	90.17	691.03
M17	31.65	13.15	7.95	5.85	76.91	767.94
M19	35.40	9.72	3.75	4.32	42.02	809.96
M22	40.30	7.33	4.90	4.05	29.68	839.64
M24	43.50	8.93	3.20	2.95	26.33	865.97
M26	46.20	10.40	2.70	4.60	47.84	913.81
M31	52.70	10.44	6.50	4.55	47.52	961.33
M33	55.30	7.87	2.60	3.50	27.53	988.86
M37	59.70	9.76	4.40	4.35	42.46	1031.32
M41	64.00	8.76	4.30	3.25	28.48	1059.80
M43	66.20	9.89	2.20	1.95	19.29	1079.09
M45	67.9	9.11	1.70	2.10	19.13	1098.22
M47	70.40	8.12	2.50	4.70	38.16	1136.39
M49	77.30	7.10	6.90	5.05	35.83	1172.22
M51	80.50	5.05	3.20	3.35	16.92	1189.14
M53	84	3.99	3.50	4.30	17.14	1206.28
M55	89.1	7.77	5.10	5.33	41.44	1247.72
M57	94.66	6.10	5.56	5.12	31.19	1278.90
M59	99.33	5.67	4.67	6.81	38.63	1317.54
M61	108.28	4.92	8.95	8.74	42.94	1360.48
M63	116.80	3.78	8.52	8.52	32.21	1392.68

Area under desorption curve: 1392.683
Initial concentration (Cmax): 30.68 ppb

Equivalent pulse-mean = 1392.68/30.68 = 45.39 hr

Extraction Well Iodide Data

Sample	t	Iodide	delt t	delt	Area I*delt	Cumulative Area
S1	0.36	0.04	0.36	3.38	0.14	0.14
S3	6.40	0.05	6.04	7.22	0.36	0.50
S6	14.80	0.08	8.40	5.95	0.48	0.97
S8	18.30	0.15	3.50	4.10	0.61	1.59
S13	23.00	0.27	4.70	2.95	0.80	2.38
S14	24.20	0.43	1.20	1.30	0.56	2.94
S15	25.60	0.65	1.40	1.20	0.78	3.72
S16	26.60	0.77	1.00	1.43	1.10	4.83
S28	28.47	1.22	1.87	1.38	1.68	6.51
S19	29.35	1.57	0.88	1.62	2.54	9.04
S21	31.70	2.3	2.35	2.22	5.12	14.16
S22	33.80	2.91	2.10	2.65	7.71	21.87
S24	37.00	4.2	3.20	2.90	12.18	34.05
S26	39.60	4.99	2.60	2.85	14.22	48.27
S29	42.70	6.28	3.10	2.60	16.33	64.60
S31	44.80	7	2.10	2.60	18.20	82.80
S34	47.90	8.26	3.10	2.05	16.93	99.73
S35	48.90	8.3	1.00	1.50	12.45	112.18
S37	50.90	9.58	2.00	1.50	14.37	126.55
S38	51.90	9.4	1.00	1.10	10.34	136.89
S39	53.10	9.72	1.20	1.00	9.72	146.61
S40	53.90	11.07	0.80	0.90	9.96	156.58
S41	54.90	10.98	1.00	1.05	11.53	168.10
S42	56.00	11.16	1.10	1.55	17.30	185.40
S44	58.00	10.37	2.00	2.65	27.48	212.88
S47	61.30	10.4	3.30	2.80	29.12	242.00
S49	63.60	9.52	2.30	2.15	20.47	262.47
S51	65.60	9.1	2.00	1.90	17.29	279.76
S53	67.40	8.6	1.80	1.90	16.34	296.10
S55	69.40	8.2	2.00	2.00	16.40	312.50
S57	71.40	7.4	2.00	2.00	14.80	327.30
S59	73.40	6.7	2.00	2.05	13.73	341.04
S61	75.50	6.3	2.10	2.15	13.54	354.58
S63	77.70	5.6	2.20	2.05	11.48	366.06
S65	79.60	5.53	1.90	2.25	12.44	378.50
S67	82.20	5.1	2.60	2.45	12.50	391.00
S68	84.50	3.91	2.30	3.05	11.93	402.92
S70	88.30	3.71	3.80	3.90	14.47	417.39
S72	92.30	3.41	4.00	4.05	13.81	431.20
S74	96.40	3.3	4.10	4.10	13.53	444.73
S76	100.50	3.1	4.10	6.05	18.75	463.49
S78	108.50	2.27	8.00	7.95	18.05	481.53
S80	116.40	1.92	7.90	6.05	11.62	493.15
S81	120.60	1.19	4.20	6.35	7.56	500.71
S83	129.10	1.44	8.50	8.25	11.88	512.59
S85	137.10	1.1	8.00	8.05	8.85	521.44
S87	145.20	0.99	8.10	8.05	7.97	529.41

Extraction Well
Iodide Data

Sample	t	Iodide	delt t	delt	Area I*delt	Cumulative Area
S89	153.20	0.85	8.00	6.00	5.10	534.51
S90	157.20	0.9	4.00	4.05	3.65	538.16
S91	161.30	0.8	4.10	7.15	5.72	543.88
S93	171.50	0.7	10.20	15.31	10.71	554.59
S98	191.91	0.54	20.41	22.67	12.24	566.83
S104	216.83	0.42	24.92	22.25	9.34	576.17
S108	236.41	0.37	19.58	12.79	4.73	580.91
S109	242.41	0.31	6.00	9.00	2.79	583.70
S110	254.41	0.29	12.00	12.00	3.48	587.18

Area under Iodide peak: 587.1766
1/2 Area: 293.5883

COM for Iodide peak: 68.11